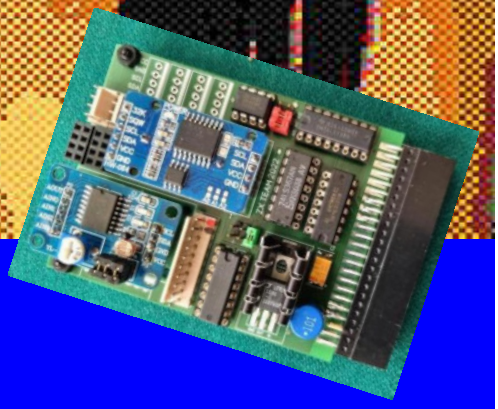
SUC-SESSION

YOUR MAGAZIN FOR THE SINCLAIR ZX SPECTRUM



- News
- Review of the Spectrum40
- ZX Spectrum 48 replica
- Discrete PIO for the ZX Spectrum 48
- Power Supply on the ISSUE3-Board
- I2C-Interface for the Spectrum48
- Adventure- solution »Anamagon's Temple«
- And much more...

ISSUE

232.

OF YOUR MAGAZINE

FOR SUBSCRIBERS WITH SCENE+ DISK

THE NEWEST AND BEST PROGRAMS DIRECTLY DELIVERED TO YOU

EDITORIAL

Hello dear SUC readers,

First of all: this issue is a hardware issue. In addition, I have again consistently practiced saving space. The hardware was not intended. That it turned out this way is rather a coincidence. After I complained in the Tlienhard forum that for the next issue, i.e. this one, there were once again far too few articles and that I had not received any so far, this caused a storm of indignation. Ashes on my head, but this provocation was quite intentional. Of course, there were a few articles, but by no means enough. Several articles have subsequently arrived, focusing on ZX Spectrum hardware and enhancements for our favorite computer. I already had planned an article dealing with a discrete I/O port anyway, added to that are articles on powering the computer, the rebuild of a Spectrum 48 based on an Issue3 board - so no clone - and an article on expanding it with an I2C interface. The latter is a real treat, since there are various extensions and sensors that can be addressed via I2C. So once again modern technology meets technology from 40 years ago.

In September there will be a couple of events again. Two should be mentioned here.

The 24th Spectrumania in Wittenberg is a fixed date at the beginning of September. Norbert Opitz has again put in a lot of work and made the meeting possible. You can find the invitation here in this issue.

The JOYCE-User-AG e.V. invites all 8-bit-friends on 17.9. to 18. 9. to the Spectra-Joyce in Wolfhagen. You will also find the invitation in this issue.

The new website of the SpectrumUserClub is online. Mirko has uploaded the new site and is in the process of expanding it. You can find it at the old web address www.speccy-szene.de.

In addition, a small thing has changed in the magazine title: it now says "The magazine for the Sinclair ZX Spectrum". The "ZX" was missing until now. Thanks for the hint, Mirko!

This time you won't read a political statement from me. Nothing has really changed since the last issue. To say it with Ralf Ruthe, the caricaturis: "And here the newest news! Everybody gone crazy!". As far as world politics is concerned, there is nothing to add.

Finally, I hope you enjoy reading this issue. As always, we have put a lot of effort into this issue.

Stay healthy!

Many greetings,

Joachim and Thomas

10th, September 2022

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The **SUC-Session** magazine appears in German and English and can be subscribed together with the disk-magazine **SCENE+** at the **»Spectrum-User-Club«**. For further information please contact Thomas Eberle.

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Copy deadline for SUC SESSION 232

Wednesday, 26th, October 2022

READERS LETTERS

Fortunately we received some letters from readers again, most of them directly after we sent out the magazine, but over the weeks it unfortunately always drops off a bit. Remember, we always need your support. It's not our magazine, it's yours, you have to fill it (or at least help to fill it). Whether it's articles or just letters to the editor, don't think something is uninteresting.

What I have noticed, both among our readers and those who write articles from time to time, is that everyone is kind of busy with other things right now. But keep in mind, Joachim, Mirko and I are busy too. We work, we have family and we still make this magazine. Most of all you thank us if you participate. Have you been waiting a long time for the next issue? Maybe something didn't work out, ask. Did you send an article, but it was not printed? Maybe the email didn't arrive, ask. If you are not sure if you paid the subscription at all... just ask.

Email to:

thomas.eberle@sintech-shop.de

The first one is *Eberhard Häger* from Schwieberdingen:

Hello Thomas, I just transferred for SUC Session package 1 via Paypal. It is actually that I had totally forgotten about the subscription. I am currently working intensively on my browser game "Dragon Knight", which I ran from 2005 to 2009. It was written with php 4 back then and now needs to be migrated to php 8. If that works out, I will probably go online with it again in about two months. Then I will continue working on my spectrum program "Arkon Castle" again. I hope that the readers and subscribers will come back in droves.

Many kind regards, Eberhard Häger

Hello Eberhard, glad to hear from you again, by Spectrum standards we live very close together, but have never seen each other. But I would definitely like to see your browser game (to compare it with the Spectrum version) and of course every new Spectrum game of yours (years ago we introduced Dragon Knight). Keep in touch, good luck with your programming.

A little mishap happened to me when sending out the last magazine. First I had written to former readers, if they don't want to start a subscription again. The following mail to all current readers I had then also started with "Dear former readers", which caused confusion. In general, however, I had also announced in both mails that the cooperation had decreased a lot and especially the printed edition was on the brink of collapse, since most of them had subscribed to PDF.

***Waldemar Brucke* from Steina writes to us:**

Hello Thomas, now I'm sad and scared at the same time, why did I not renew the subscription, I honestly can not explain. Probably overlooked and lost sight of. I am still very interested in a subscription with disk. I have received issue 230, but unfortunately without the diskette. Is there still a chance to get the issue 231 with diskette (Opus)? Please contact me, also for payment.

Greetings, Waldemar

***Dieter Hucke* from Hofgeismar writes:**

Hello dear Thomas, as for me, yes I definitely want to continue to have the paper SUC magazine! Why do some not renew their subscription? Well, I can only speak for myself now and it is not a criticism, but what it is for me:

I never get to know when my subscription expires. That's 100% up to me, but still :-).

Wolfgang always had an extra note put in with those whose subscription expired. I don't know how else to do it well, but I imagine others feel the same way I do, that the end of subscription time just isn't present?

I know you do it with the point system, but how about making it so that the subscription always covers the calendar year? Then the rewards for articles don't implement as well, but you could clearly remind in the last issue of the year that the subscriptions expire?

I wouldn't mind tacit renewals either, but then you might have to chase the money for some.

I hope very much that "WE" (I take myself in there quite consciously), better pay attention to when the subscription expires. For me, I do it like this: as soon as I know when my subscription expires, I make myself a reminder in the calendar two months beforehand, after all, what is this thing for :-)

Best regards and CONTINUE 0:1 :-) Dieter

***Burkhard Taige* from Bargstedt also feels affected:**

Hello Thomas, as I am only subscriber since the 229th issue, I do not think that I already belong to the circle whose subscription expires. Nevertheless, I am now not clear about when I actually have to renew my subscription. Is there a corresponding notice just before expiration?

Best regards, Burkhard

P.S. I have brought some ZX Spectrum replica boards to life and would like to report about it. Would that be worth an article in the SUC session?

***Frank Ruthe* from Wittingen got in touch right away:**

Hi Thomas! I am indeed surprised too! First of all: I am still highly interested in a printed edition of the SUC-Session. I would even pay one or the other Euro more for it (in case financing should be a problem...).

What happens to me more often: I have quite a few "real" subscriptions (i.e. with real publishers

behind them), as well as regular "fanzines" like the SUC-Session. With the former, I'm usually automatically reminded of the reminded of the expiration, while with the latter there is not always a "heads up". I myself often don´t have in mind, that I would have to add a few more Euros to my account...

So if my SUC-Session-Subscription is one of the ones that has "expired" now, let me know and I will renew immediately! :-) Maybe others will feel the same way.

I hope, of course, that it will continue,

Many greetings, Frank

Christof Odenthal **from Rudelzhausen gets in panic:**

Hello Thomas, has my SUC session subscription expired? I'm sorry if I didn't notice, of course I'm still here! Maybe it happened to others as well? Well, I always look forward to the magazine, but I have to admit that I don't read every article.

If the Scene+ should continue to exist, I could also switch to the digital form to reduce the effort for you. At the moment I am also more concerned with the Next than the MB02.

Many greetings, Christof

Harald Lack **from Rosenheim is even shocked:**

Dear Thomas, dear Joachim!

What can I say, I am in shock!!!! I myself have been with the Spectrum-User-Club for a long time, but such news makes me doubt us. I have always looked forward to the SUC Session, earlier as Papermag and now for a long time as PDF edition. If you ask around, it is clear that the Speccyscene is quite active. So there is a lot to report and such a club magazine is made for finding a lot in one place without having to search for hours in different sources. So I think this is great! Thomas and Joachim do an incredible amount of work (in their spare time) to provide us with great information. You have to keep that in mind. Unfortunately we don't really manage to activate more authors although there are so many topics. I report (relatively) regularly about adventures. For the future I still have a lot of plans! The world is crazy enough to play with our existence anyway. So it's good for the soul to have something to do with the Spectrum. In this sense I really hope that we get our butts up just now that our Speccy has turned 40. It's time for a fresh start. On that note, THIS SHOULD NOT BE THE BEGINNING OF THE END!!!!!! I count on each of you!!!!

Harald

Ingo Truppel **from Potsdam vows improvement:**

Dear Thomas, dear Joachim,

I am especially happy every time I get the SUC-Session and the Scene-Disc. I would be very sorry not to be able to get either or both magazines anymore. I don't use Facebook any more than I use Twitter or similar asocial networks. As an avid user of historical technology, I also particularly enjoy using real floppy disks and cassettes. When I buy a newly released game for the ZX Spectrum, I always try to get a real cartridge or floppy disk if applicable. If the floppy magazine were replaced by an emulator-ready version (TAP file), it would become much less important to me and I'm not sure I would stick with a subscription. I would be happy to pay more for the subscriptions or assist in obtaining blank media. I very much regret not contributing enough to the magazines in the past and will try to do better in that regard. If, in the 41st year of the ZX Spectrum, these unique magazines would be discontinued, it would be a bitter loss for the Spectrum scene.

Best regards from Potsdam, Ingo.

This is as far as an overview as a reaction to my somewhat wrongly formulated mail. I would like to answer and respond to all of you together. First of all, I am sorry that I shocked some readers who still had running subscriptions. The salutation was of course a mistake, sorry.

Now as far as the magazine is concerned, of course you have to be open to new things. So the question was: if a paper magazine is no longer in demand, what then? Something interactive? Film? A website? I've seen great things, e.g. Crash has been twice published a special issue that was digital, similar to PDF, but e.g. the screenshots of games were animated and at the click of a mouse you could directly play the game in a browser window. I can't implement that, or not yet, but it's interesting. It is important to me, and also to Joachim and Mirko, that we do something that interests everyone. It's not about the financial, but about the time. Our team spends days of our free time so that the magazine lands in your mailbox. But the circulation has become smaller and this against the trend that there are actually more and more active Spectrum users, more and more hardware and software is published and also bought.

Of course, the PDF subscription is cheaper, is it the price? No one could answer this question for me, those who wrote would like to have the printed magazine. So it seems I asked the wrong people or the wrong people felt concerned. I would like to keep the discussion going and ask the others here: Should we discontinue the printed magazine and only publish it as a PDF? Or a completely new format (online - website)?

Another thing about the subscription: I am not entirely happy with the fact that we offer a subscription for three issues rather than one year. But since the SUC session is still a hobby and we want to be flexible with the issue, I guess it's not possible otherwise. So we can sometimes produce four issues in one year, in the past there were sometimes only two (unthinkable at the moment, so much is happening). But we always remind you when the subscription expires, firstly

by e-mail and secondly by an insert in the magazine (if you have subscribed to the printed edition). We then almost always remind everyone who has not yet renewed by email before sending out the next issue. What I miss is often the clear answer, which then leaves me in the dark. Did the recipient not receive the email? Does he not want to answer, is he disgruntled? Or deceased. So it usually ends up that I write not one but five or six emails, so then finally also the mail before the last issue to the "former readers".

It is important to me and to the others to use our time wisely. We like to do the magazine, but it doesn't make sense to create a disk that nobody puts into the disk drive anymore. That is why the SCENE+ will not exist in the future. If we want to continue with the SUC session, we are willing to do so, but then something has to change, more collaboration, more feedback and at least a proper sign-off at the end.

The reason we don't distribute the SUC Session as a PDF for free is because we want to give the magazine a value. If we were to distribute it for free, the question for us would be whether anyone reads it at all. Feedback tends to be lukewarm unless you send a shock email by mistake. It was also suggested to use direct debit. That might be possible somehow, but on the other hand we make this effort with the magazine and the readers only have to make a bank transfer once a year, which we point out 2-3 more times. I think it should work this way after all and thus remain simple for everyone. When Mirko was not running the club and we used to have annual dues, some did standing orders. That was over 10 years ago now, and if I had not changed my bank account then, I would still be receiving payments once a year for the subscription to this day. As I said, it is not about the financial, we want to do something useful, that you read our magazine and give feedback from time to time and at least reasonably independently transfer the contribution or just leave properly. I hope we get this implemented.

Gary Cordery **from Southend-on-sea (UK) misses the SCENE+ diskette.**

I renewed my subscription in March with the option of three magazines plus disk. I think I did everything right, but I only got a PDF.

By the way, if you have any diskette - magazines left, I will be happy to buy them.

Hello Gary,

the SCENE+ disk is part of your subscription of three issues. But it comes separately, not necessarily with the first of the three issues and maybe not even with the last. The timing is uncertain, I definitely plan to do it this year.

We can still create everything in principle if there is demand. We might also think about a kind of webshop on our site, where you can order back-issues. We still have issues from the last 28 years... but on the website we have not implemented this yet. In the meantime I can offer you everything, just write me what you want.

Jay Mundy **from Maple Ridge (Canada) sent us a variety of ideas right away:**

Hi Thomas, I think you have several problems and issues that are affecting sales of your magazine.

1. the format is not appealing. Too much text and not enough color and photos. Make the pages colorful, add more photos and screenshots, and revise the layout to make it look more like Crash.

2. it's impossible to order the magazine. I have no idea how to order it, and even this email from you doesn't have a link to a website. When I google "suc-session magazine" nothing comes up. Your email reply address is "sintech-shop.com", which has nothing to do with the magazine. Make a "suc-session.com" website (The URL is there) with nice pictures of the magazine and a button to easily order with paypal or credit card.

3. If you offer both pdf downloads and printed versions, you will lose physical sales because people will download the pdf version. Offer something in the printed version that is not included in the pdf version.

4. focus on content for the Sinclair Spectrum and ZX Spectrum Next. There is a large Spectrum user base.

5. solicit contributions (articles, reviews, etc.) from people in the community to generate interest. I can submit an article for you about the ZX Spectrum Next if you like.

6. Promote your magazine in the many ZX Spectrum and ZX Spectrum Next Facebook groups with a link to easily order the magazine.

7. Start a Facebook group for the magazine where people can join and see the updates you will post about the magazine.

8. Send free copies of your magazine to YouTube content creators, especially Thomas (TJ) Ferriera, who has a "Sinclair Society" Facebook group and YouTube channel

(https://www.youtube.com/channel/UCWVlpFOHWaoDNJwPow-wUIA).

9. start a monthly subscription on patreon.com, as Crash does.

(https://www.patreon.com/crashmagazine) so people can pay monthly and not have to remember to order manually each month or every time it comes out.

Note that most customers for a Sinclair magazine live in the UK. However, I am in Canada and would love to have your magazine.

Feel free to contact me if you have any questions.

https://www.facebook.com/MrJayMundy/

Cheers, Jay

Thomas: Hi Jay,

Thanks for the multitude of suggestions and the view from someone who has just joined. Of course, our magazine is not as professional as CRASH for example. We can't do that, putting text into a magazine is not our profession nor do we have the appropriate high quality software to do it. There was an attempt to make the whole thing more colorful 10 years ago, but readers rejected it because it was too hard to read. I also notice this with Crash, it is more colorful, but easier to read is black on white.

The website is also a concern for us. This is now much clearer and more concise. Is it better this way? We would probably have to use more keywords here like "SUC session." Essentially, if you know the history of the oldest active Spectrum club in the world, we are the Spectrum user club and the SUC session is the club's magazine. So you would have to google Spectrum user club. Also, our Facebook presence is "Spectrum-User-Club." As a club, we primarily want to promote communication among our members, so the articles should come from the members. But it's a good idea to solicit articles from people outside this community as well.

We have also used Patreon, but in the case of CRASH this is difficult, Patreon offers monthly payments, but the magazine is not published monthly. So you always have to switch off two months, if you forget once, you receive unauthorized payments. In fact, I forget more often; we are not a publishing house with professionals who earn their money that way, we just do the magazine in our spare time as a hobby.

I see that the problem is probably primarily the lack of awareness, despite advertising in Facebook groups. We will try to implement some suggested activities.

Thomas has actually already said everything. Nevertheless, I also give my opinion. Thomas writes correctly that the project "SUC Session Magazine" is a pure hobby project. I, as the one who is ultimately responsible for how the magazine looks and what is in it, work with the means I have at my disposal. Of course, I could include more pictures, but that would greatly reduce the space available for other articles. Ultimately, it's a matter of cost. More pictures means more space for the other contributions and thus a larger issue size, which makes the issue more expensive. So we would have to increase the issue price to accommodate that. From my side, I am not willing to invest money in professional software for layout design, because I simply don't have it. We, the makers of the magazine, don't make money from it like the makers of CRASH have to. The Crash is commercial, we are non-commercial, which makes a big difference. The CRASH is colorful and always reminds me of the bubble gum commercials of the 70s. I don't want that. In the SUC session, I think the focus is on information.

Jay's suggestions are all good, I am open and positive to them, as far as they are feasible with our means. But due to our possibilities they miss our reality, at least at the moment.

Joachim (red)

Hans Jørgen **Kramp from Solrød Strand (Denmark) tells a bit how he found us:**

Hello Thomas, I have just renewed my subscription and told Mirko my new address.

Two years ago I resumed my hobby with Spectrum after a break of more than 30 years. In the last two years I have bought (too)many accessories and computers and have a (somewhat) large collection of vintage gear, spiced up with new hardware that I am still impressed with the making of. I appreciate fixing ZX printers, microdrives and specs, getting the AMX mouse interface to work with the Smally mouse for the BBC, soldering daughterboards for my Issue 1, assembling a Harlequin and transferring the old (and new) programs to microdrive (vDrive ZX).

Thank goodness I hoarded quite a few parts before Brexit, because no matter where you look these days, most of the equipment was sold in the UK.

When I bought some ZX-EXT from you 1½ years ago, you introduced me to the magazine, which I have been delighted with ever since. There is just something different about sitting on the couch with a real magazine than with an iPad or computer. Unlike my Play subscription (Play Station), I actually get around to reading it.

I've never been a fan of the floppy disk solutions. I still think microdrive is the most authentic, and with a vDrive you get the best of both worlds - 100% compatibility and 100% reliability. I'm happy with the TAP file, as it provides a collection that can otherwise only be found in fragments on the internet.

So: please continue with the magazine. Users of the floppy disks will probably be fine with the TAP version. You do a great job that is appreciated.

With best regards, Hans

Hello Hans,

thank you for the praise. We will think about publishing a TAP compilation of the best programs in the future. That's still up in the air, for now we have a real disk edition to do and we'll see that this one will be especially good.

Martin Weltzer **writes to us from Munich:**

Hello Thomas,

my renewal has just gone out by bank transfer. I still think a floppy disk for the Scene+ is good. I rather observe that the retro community is constantly growing - a proper medium like the floppy disk is part of it. In contrast, a paper magazine is dispensable from my point of view, here the download is enough. That makes the work for you at least a little bit easier.

Thanks for the last Scene+, despite expired subscription. I know the club lives on the activity of

the members and I am unfortunately very passive. I don't want to promise anything, but the will to support is there.

Best regards, Martin

Thanks for the feedback, Martin. It is of course true that especially with CRASH a good full-fledged magazine already exists. On the other hand, SUC-Session is the only magazine that is published in German and English and thus aims to combine knowledge from all areas. In contrast to other magazines, we do not only deal with software, but in many cases also with hardware. I don't see a paper magazine as a must, but for many it is pleasant not to read on the screen. The subscription figures will show us whether the paper magazine will also exist in the future.

Bodo Langer **from Dinslaken will conclude today:**

Hello Thomas,

Thank you very much for sending me the latest issue of SUC Session, which is, as always, very well done. Sorry that I am only getting in touch now. I had relatives visiting from France and therefore didn't get to it before. I just transferred the amount of 20 euros for package 2, as my subscription had expired.

The 231 was on my envelope and the note was also enclosed. I find this procedure good and I would have no idea how to do it better.

The only problem I have is that I actually always feel guilty about not contributin to the magazines. That's because I'm basically very interested in the subject matter, but unfortunately I wouldn't describe myself as a specific expert, but rather as a retro lover who doesn't really have the necessary clue to contribute something interesting.

Therefore I would like to hold back in the matter of activity for the time being. Maybe this will change in the future. Many greetings and a nice week, Bodo

Hello Bodo,

as you can see from the letters, there were some renewals, so that it looks a bit better with subscribers. But it is nice to hear that our procedure with slips of paper is already a good one. The only thing we could do better is to send Joachim (black belt) to collect contributions. In case someone is thinking about not transferring the money right away: We are still considering this option.

(Karate, 2.Dan. I can imagine that this would be fun for you, dear Thomas. Where is the Ferrari you promised me?! /JG)

Apart from that, I can think of a few things that a retro lover can contribute. A nice interface, a great game or just describe your own configuration. Gladly also with pictures. That's how fast an interesting article is made. Maybe you will think about it.

NEWS IN SHORT

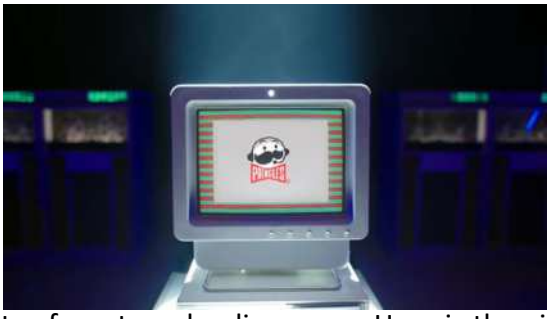
SPECTRUMPEDIA

A comprehensive work about the Spectrum from its origin until today has been published in Italy. There are 2 volumes, both can be downloaded in Italian, the first part also in English. The second volume will also be translated into English. The encyclopedia is also available for purchase, but only in Italian. Here the page with links:

https://www.alessandrogrussu.it/sp.html

PRINGLES CONGRATULATES

Yes, even though Pringles does not produce computer chips, but potato chips, they obviously have a connection to the Spectrum. I guess chips somehow belong to hardcore gamers and the hardest ones are the ones who waited another 5



minutes for a tape-loading-error. Here is the video with which Pringles celebrates the Spectrum's 40th birthday:

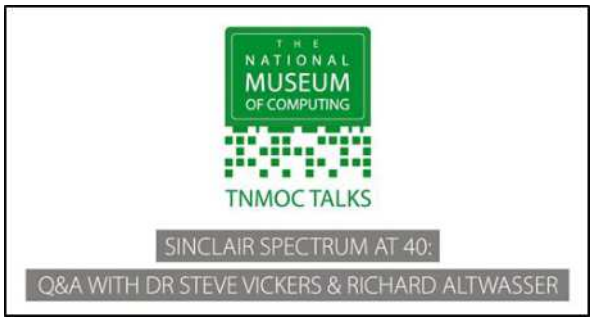
https://www.youtube.com/watch?v=Rjyj0V9JeVA

SUC WITH NEW WEBSITE

Mirko has updated our website a bit. A big download section will follow. Unfortunately everything is getting more expensive and so we will probably have to update the site more often than before just for price reasons. How do you like the new bright design?

www.speccy-scene.de

THE NATIONAL MUSEUM OF COMPUTER - SPECTRUM 40



Unnoticed by me, an event for the 40th birthday of the Spectrum took place at the national museum of computer in Bletchley (UK). April 23 would certainly have been suitable for a round trip, first to Blechtley and a week later to Walsall. Unfortunately I missed it. Fortunately there is Youtube and an interesting part of the event can be found there as a video. Steve Vickers and Richard Altwasser, two of the "fathers" of the Spectrum tell interesting details and we can watch it now:

https://www.youtube.com/watch?v=nLnuY3EKnWE

If you are also interested in the video with Sir Clive's son Crispin, you can find it here:

https://www.youtube.com/watch?v=EEHbuVZ_Kgg

CRASH LIVE EVENT 2022

Motivated by the Spectrum40 event in Walsall, Chris Wilkins (Crash Magazine, Fusion Retro Books) has now decided to hold a Spectrum event at the same location in 2022. There have always been plans to hold an event in November, now it will take place. Unfortunately we don't have an exact date yet, but there will be several exhibitors, well-known speakers, about 40 Spectrums to play, contests throughout the day, other systems and slots with classics and all visitors will get an exclusive Crash magazine and there will probably also be an exclusive game released at the event. Sounds all very good already, you will be able to read more soon on:

https://fusionrgamer.com/2022/05/21/crash-2022-live-event-announced/

BBC HORIZON DOCUMENTARY: SIR CLIVE SINCLAIR - ANATOMY OF AN INVENTOR

Not necessarily news but worth mentioning. In the Internet Archive, a non-provit library, you can find a BBC documentary about Sir Clive Sinclair, which was filmed in 1988. The picture quality leaves much to be desired, but the documentary is nevertheless very interesting. (jg)

https://archive.org/details/BBCHorizonCollection512Episodes/BBC+Horizon+-+s1989e18+-+Sir+Clive+Sinclair+-+Anatomy+of+an+Inventor.avi

CLUB MEETING 2022
JOYCE MEETS SPECCY, SAM AND FRIENDS
SPECTRA-JOYCE

Open for all 8bit computer friends.

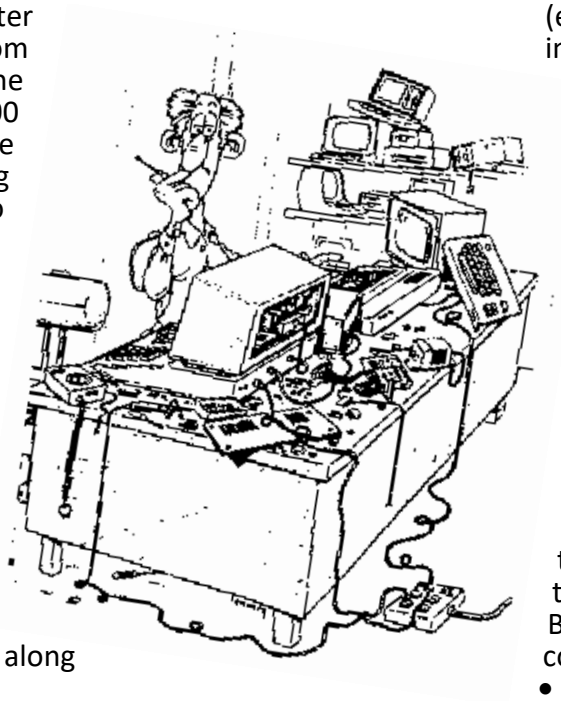
17 - 18 September 2022 in Wolfhagen-Nothfelden (district Kassel)

A weekend - many JOYCEr of the AG and many Specmaniacs of the Spectrum & SAM Profi-Club Cologne are already looking forward to. One meets nevertheless old friends again and can attach new friendships. Computer fans, who know each other only from the telephone, from letters or via eMail, can meet here personally. What awaits the visitors of this year's club meeting in detail ??!

First of all, our club meeting is intended to serve as an opportunity to exchange experiences and to talk about our beloved homecomputers. Our club meeting is not a fair for computer cracks, but a meeting of computer friends, for beginners and advanced users alike. Like our clubs, the club meeting is also characterized by the exchange of experience - the more computer enthusiasts contribute, the more fruitful our work will be. This meeting is therefore a casual gathering of inquisitive users from both clubs.

Secondly, our club meeting is to inform about the Spectrum, SAM and JOYCE, as well as other 8-bit computers and their applications. If you have questions about certain programs or hardware, you surely will find a contact person, as well as users, who want to inform themselves about the possibilities of their 8-bit oldtimers.

Program schedule: We want to stick to the club tradition and not be subordinated to a rigid program schedule. On Saturday the brought computers can be set up in the hall of the village community center Wolfhagen-Nothfelden from approx. 10.00 o'clock. In the time from 10.00 to 20.00 o'clock the computer life rages. On Saturday evening there is the possibility to explore the gastronomy of Wolfhagen. On Sunday it goes on from approx. 10.00 to 16.00 o'clock. On both days there will be the possibility to have lunch together (we have a first class pizza service as well as a super kebab delivery service), drinks and coffee will be provided as well.



What should the computer fans bring along besides a good mood ?

- As far as possible and desired, each visitor should bring his computer (this is not an obligation, but opens many many possibilities). Extension cords and double plugs should also be packed and brought along.
- Those who have written their own programs should bring them to the club meeting.
- Maybe a flea market for used software & hardware can be realized again. Who would like to separate from his duplicate computer goods, should bring these, maybe you can sell it for a good price.
- Who has questions to special software, used by him, should bring this software, because only in such a way a successful problem discussion is possible.
- Journey to the club meeting:
- By car: Look for the A44 (Kassel-Dortmund) on the map.
- Coming from Dortmund, take the Breuna exit (exit 66); turn right onto the L3312 in the direction of Wolfhagen; drive through Niederelsungen and take the second street on the left in Nothfelden; drive around the church on the right and turn left into Bruchfeldstraße to the village community center.
- Coming from Kassel, take the Zierenberg exit (exit 67); turn right onto the B251 towards Wolfhagen/Korbach; pass Burghasungen, Oelshausen and Istha (from here B450); in Wolfhagen, turn right at the traffic lights onto the L3314 towards Breuna. In Nothfelden take the fourth right into Bruchfeldstraße to the village community center.
- For friends of the navigation system: 51° 21' 08.2" N 9° 12' 44.9" E

If you want to be picked up from the train station (Wolfhagen), please write to me in time (postmaster@joyce.de.).

Werner Neumeyer-Bubel

P.S. Also who needs urgent help in assembling his computer will find adequate help on the SPECTRA-JOYCE for sure.

Help for overnight guests: We are happy to assist you in finding a room!

(All information and much more can be found on the website of the JOYCE-USER-AG e.V.. The page is worthwhile. Check it out at www.Joyce.de. jg)

THE JOURNEY TO THE SPECTRUM40
THE 40TH BIRTHDAY PARTY
BY THOMAS EBERLE

I remember my 40th birthday well. "At 40, the Swabian becomes wise," they say here... That's why they celebrate it in a big way. I wanted to do something similar for the Spectrum, with the hope that it would not become an Archimedes. So I teamed up with Lee Fogarty (the proven team that organized Spectrum35) and we organized a user meeting in Walsall, in the heart of England. The reason why it had to be Walsall was quickly clear and convincing:

Walsall is not a huge city, but it has everything you need and above all the perfect premises in the Bescot football stadium. That's why retro events have been held there before. It is in the middle of England and therefore easy to reach from all corners of the British mainland, and with Birmingham in the immediate vicinity, an international airport is also close by. Previously, the events were held in Cambridge, the birthplace of the Spectrum, but the famous university town is also a noticeably more expensive place and train travel there were also more expensive.

So we wanted to offer a larger venue and also save the visitors' money. We succeeded in doing both.

As an organizer it is then not easy to write little euphorically about the show we organized ourselves, but despite calls no one else could be found. I try in the following now as neutrally as possible as a travelogue my experiences to reproduce and so perhaps also awake something like adventure desire on making journeys to cities not everyone has visited yet.

The adventure already began at home, in front of the screen. The question: what is better? A flight to London and a train to Walsall or a train to Frankfurt airport and a direct flight to Birmingham? Unfortunately, there were no flights from Stuttgart to Birmingham, but the train ride from London to Birmingham is shorter than Stuttgart to Frankfurt and the Deutsche Bahn doesn't have the best reputation anyway - so London was booked. Had I considered that London is big? That you have to drive half an hour from Heathrow Airport to the city center? That then I will be at Paddington station, from which, however, no trains go to Birmingham? Of course not. But that's not so bad. So the next task was to find the train connection. But this is a much more grueling process than you might think, in Germany you usually go to the Deutsche Bahn website for something like this and miss out on offers from the few regional providers or Flixtrain. In the UK, the entire rail network is spread across many operators with their own trains. There is not one website that shows (almost) everything, but each operator has its own offer page. Similar to flight portals, there are also such portals for trains, which summarize some trains, but not all. The price difference on different pages then went from 80 down to 22 pounds for my train ride, in the end I think I found my way after 2 hours of research. From the airport to Paddington for 11 pounds, then an hour walk to Euston station and from there to Birmingham, changing trains there to Walsall. In principle, I would leave for the airport at 10am and arrive in Walsall at 7pm, including an hour's gain due to time difference, so a total of 10 hours on the road. It became a little more...

A room was booked via AirBnB, I love this portal. If you want not only cheap accommodation, but also want to get to know the country and its people, there is no better alternative. To take advantage of the cheapest flight, I left on Wednesday 27th April, on Saturday 30th April was the event and on 02 May went the return flight. The flights were many times cheaper than on other days, so that I could treat myself to a few days of vacation without additional costs due to the savings. Vacation in Walsall... I'll get to that later.

Basically, I had a generous window of about three hours from the arrival of the flight to the departure of the train at Euston. Still, I was not allowed to dawdle. Heathrow Airport is quite a bit larger than Standsted, for example. The five terminals are connected by a dedicated railroad, but you still have to calculate a good half hour walk from the terminal to the departure of the train to London... and I was even walking fast. The train ride took another half hour. Thanks to navigation with the cell phone I found also my way to Euston at the first go and had also still time for a lunch. In Euston, a weakness of the British railroad system showed up again. In the ticket hall hundreds of people stood and waited for the display to see from which track their train departs. In Stuttgart, people know six months in advance which track which train will be departing from. Hopefully it will stay that way when Stuttgart 21 is finished (which will only take 10 years longer and should actually be called Stuttgart 31). For my train, of all things, the lack of clarity lasted a very long time; about 10 minutes before departure, my train finally appeared on the display board. A queue formed immediately in front of it, the tickets were checked manually. It seemed to me almost as if the train employees trusted that everyone in the queue would get in line, it would probably have been easy to bypass the queue inconspicuously. Covid19 no longer played a role in the UK at this point, fortunately, otherwise they would have been very surprised at the queues in the ticket hall and now in front of the train. In Germany, masks are still compulsory on buses and trains, but in Great Britain, no one wore a mask at that time. At first, the seats in all the wagons were reserved, although no one was sitting there. But then I also found non-reserved seats, but without power sockets. The reservation system in the UK allows free reservations, apparently even if you

From left to right: Sandy White, Kevin Toms, Rich Stevenson, Jon Hare, Mevlut Dinc and Thomas Eberle

are not on the train. I can't explain it any other way. The highlight of the trip was an incomprehensible announcement in the train one stop before the destination in Birmingham. All passengers then left the train, since this probably did not continue and it should continue at another track. When all arrived at this track, there was another announcement and all went back, and the train continued. Due to the stop, I missed my connection and had to wait in Birmingham. This gave me the opportunity to take a quick look at Birmingham.

The rest of the trip was smooth, I noticed the relatively dense population in the middle of England. My thought was that it is a pity that no soccer club in Birmingham plays in the Premier League, there rushed past me the station of Aston Villa. Again what learned, the "Villains" are thus from the proximity of Birmingham. When I arrived in Walsall at about 8 p.m., I immediately realized that I was not in London and not in Cambridge. On the half hour walk through the beautiful city center to the outskirts there were empty roads and I met just two people. Arrived there I noticed that I had nothing for dinner, so I immediately went to the Lidl supermarket, which I had seen on the way. It was open until 9 pm. It was funny to be on the road for 10 hours just to shop in a supermarket whose headquarters is just 20 km from my home.

The days before and after the meeting I strolled through Walsall. I tried to find an appealing pub, at least I came across a very nice one, but which almost never offered food. Interesting were the statements anyway: "Oh darling, I am afraid not after 5 pm" or "Oh sweetie, not on a Sunday". I also wanted to experience a football game in a pub or sports bar, but I remembered that differently from other places. Anyway, the sports bars were in such a filthy state that I didn't want to eat there. Finally I found a nice brewery that served good food, had a nice atmosphere and nice service and screens. Unfortunately, there was no football game. It must have been a weekend without a game.

On Saturday morning we finally started. My business partner Darren, with whom I run SINTECH.UK, picked me up shortly before 9 a.m., so I didn't have to look for another way to the stadium. Arriving at the stadium, all nine planned exhibitors were quickly there and we started unloading the vehicles. There was no signage yet, but the stadium staff was very professional and did it right away when I pointed it out to them. So from 10 o'clock on, every visitor could find his destination. I had been informed a few days before, that the person who was scheduled to conduct interviews with the invited guests would not be coming. So I took over the task. I had therefore prepared for the guests and although I got a completely different picture when I googled for Sandy White, this and the other interviews went like clockwork.

Karaoke in the evening: Andrea Hall has taken over the micro

The other vendors and Darren had done a great job offering a colorful array of Spectrum hardware, software, accessories and books. In one area computers were set up for playing, but in addition most of the other stalls had a Spectrum running (even an Amstrad CPC had strayed in). Especially worth mentioning was the world premiere of a multiplayer game using the ZX-VGA. Due to ZX-VGA, the Spectrum +2 had both a screen connected to theVGA output and a second screen connected to the RGB port. Both screens gave a different picture, on one a player was playing a PACMAN who has to eat the dots, on the other screen were the three ghosts, each with only a small visible part of the screen and chasing the PACMAN. The winners were either the ghosts or PACMAN, a game that thrilled everyone for four players with a special port conversion for four joysticks.

The program on stage was quickly delayed by an hour, but somehow we made up for it. The conversations I was allowed to have on stage were in my eyes entertaining and informative, since all the guests were programmers, you can say the tenor was that the guests on stage didn't even know how many fans they had.

To meet the creators of such hits as Ant Attack, Last Ninja II, Football Manager or Microprose Soccer was a special event for me, partly there were also the biographies of these people for sale, but nothing can replace the personal impression.

It was also interesting to learn that most of them became professional programmers rather by accident, actually they just wanted to implement an idea. It should be noted that nowadays it is no longer possible to enter the industry in this way.

Sandy White with Sindy Lauper (?)

All are really great and interesting people, as well as the visitors, who did not come in droves, but nevertheless enlivened the hall which was designed for up to 400 people. In the end, there were about 120 visitors plus about 40 exhibitors, helpers and speakers. It should have been more, but thanks to Covid almost all visitors from other European countries were absent and even in the UK probably not everyone wanted to make the trip.The event was rounded off by an evening program, which I also felt was a special highlight. After the booked singer took a break in her 80s program, Andrea Hall took over the microphone for some Karaoke songs, which was frenetically cheered by the rest of us. Soon others joined in, and even if the singing would have scared everyone else away, for us it was the successful conclusion.

I felt it was a successful event that certainly deserved more attention from the media. At least, Chris Wilkins of Retro Fusion Publishing (Crash) got the idea of another meeting out of it and so the way seems paved for future regular Spectrum events in this great location. I'll be sure to come back then.

The return trip was less spectacular but similarly exhausting as the way there. Two German visitors I met seemed much more relaxed, having taken the route to Birmingham via Frankfurt Airport. I will keep that in mind.

te

»ANAMAGON'S TEMPLE« - 1988 MEDIANDROID

HARALD LACK

Hello everybody!

Today a solution of an adventure game which in my opinion falls under the version "quick and dirty", because it seems to have been put together a little bit unkindly. Officially it is the successor of "The Fantasy" which was released one year earlier. Anamagon's Temple dates back to 1988 and was published by Mediandroid. It was written, like many adventure games of that time, with the help of “The Quill”. All in all, it is very simple and not difficult to solve, if it weren't for the many errors that are inherent in the program. For example there are spelling/grammar errors that appear on closer inspection, and the one or other logical error has also crept in. But we don't want to be too critical. It's just a pity. What really bothered me about this adventure was on one hand that certain directions were not obvious and on the other hand that some objects appear that you only need under certain conditions. The best example of this is the food and wine, which you only need if you wander around for too long. This can easily happen, because there are many directions, so it's not so easy not to stray from the "right" path. Moreover, in many locations the use of HELP is possible, which always brings to light very incoherent tips. Moreover, they may be partly repetitive, which doesn't necessarily get you anywhere either. In my plan there is also a room (number 9) which has the property to exist, but without leaving it via a certain direction you automatically come back to the room (8). You just have to accept that. But now enough of the preface and criticism.

As with all adventure games, there is of course a more than short story behind this work, namely that our father disappeared some time ago and we suspect him to be in Anamagon's temple. We have to get there first in order to finally free him. So you don't really know anything and yet you know everything. Therefore now in the connection times the location descriptions of my plan. My solution extends over a total of 34 locations, which makes the adventure one of the smaller representatives of its kind. But it still took me a while to find the way. Let's start...

01) Descended into a new land
02) In the west of Benzar wood
03) Deeper in Benzar wood
04) Deeper in the forest
05) The forest appears to thin out in a easterly direction
06) The forest is beginning to get on your nerves
07) The forest thins out quite rapidly
08) The forest seems to go on to invinity in every direction / some rope, piece of old scroll
09) Up a tree near the tree monster

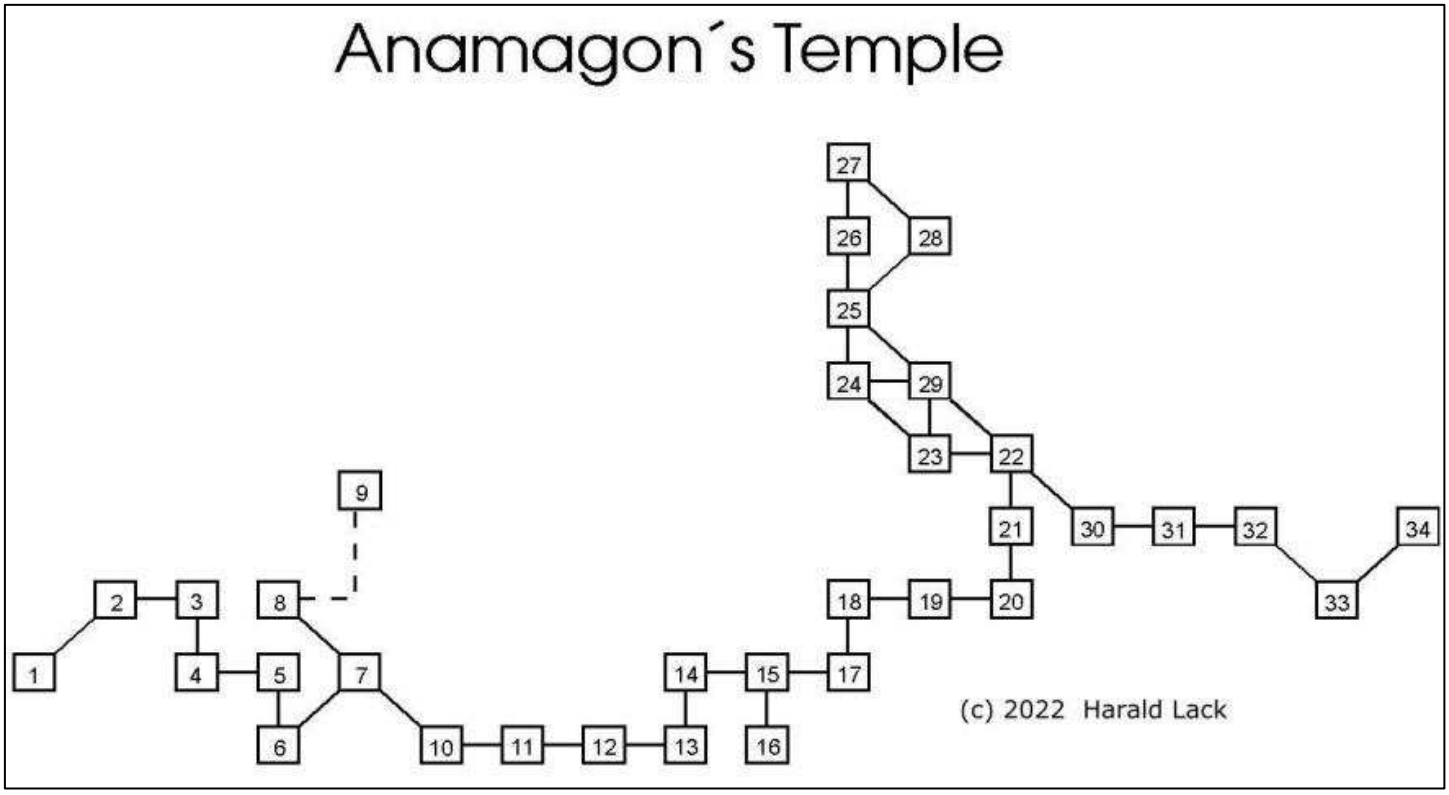
10) On a dark black dirt track
11) The track continues into the distance / bag, emerald, precious stone holder, pen
12) At the end of the track /silver pine cone
13) In a small village
14) Inside on of the huts
15) In a courtyard surrounded by huts
16) In another small hut / staff of coron
17) In the living room of a large house / knife, arrow
18) In another room inside the house / some food
19) In a shed at the back of the house / fishing rod
20) The river winds on / fish, river horn
21) Looking east from the river near a huge temple
22) On a river that connects to the inland sea
23) Not far from the coastline
24) A large inland sea
25) On a small beach beside the great inland sea
26) In the entrance to a large cave
27) In an opening in the cave / blue fire, spear of heart
28) In the cave of shadows
29) The sea gets bigger
30) At the entrance to Anamagon´s temple / mountain eye -> magical eye
31) In an arched corridor
32) Still in the archend corridor / Anamagon
33) In a vast room / cage of light, Dad
34) In a room like a vicarage / spectroscope

So much for the unimaginative locations. And with that, we'd better get straight to the step-by-step solution....

INVENTORY (already now we own an amulet and have a bottle of wine with us - what you carry along as an adventurer), EXAMINE AMULET, NE, HELP, E, HELP, S, HELP, E, HELP, S, HELP, NE, HELP, NW, HELP (good, that the HELP series has come to an end for the time being), TAKE ROPE, EXAMINE ROPE, THROW ROPE, UP ROPE (the tree monster located here wants a "pine apple" from us - and we are down again), Go SE, SE, E, TAKE BAG, EXAMINE BAG (here we find an emerald, a stone setting and a fountain pen), E, TAKE CONE, EXAMINE CONE, W, TAKE EMERALD, DROP BAG, EXAMINE EMERALD (has been torn out of the setting), TAKE HOLDER, EXAMINE HOLDER, HELP, W, NW, NW, THROW ROPE, UP ROPE, GIVE CONE, TAKE SCROLL (seems to contain coordinates, just wonder how to use them), SE, SE, E, E, E, N, E, S, TAKE STAFF, EXAMINE STAFF, GET EMERALD, TAKE STAFF, N, E, TAKE KNIFE, TAKE ARROW, EXAMINE KNIFE, EXAMINE ARROW, Go N, TAKE FOOD, DROP ROPE, E, TAKE ROD, EXAMINE ROD, E, CATCH FISH, DROP ROD, TAKE FISH, EXAMINE FISH, OPEN FISH, TAKE HORN, EXAMINE HORN, BLOW HORN (in return the monster tells us about the spectroscope we will need), DROP HORN, DROP KNIFE, N, N, W, NW, N, N, N, EXAMINE FIRE, THROW ARROW, TAKE SPEAR, EXAMINE SPEAR, SE, YES, 5THR 5THR (you have to figure it out first - as a reward the ray shows us the way to the temple), SW, SE, SE, TAKE EYE, EXAMINE EYE, DROP EYE, TAKE EYE, E, E, EXAMINE ANAMAGON, THROW SPEAR, SE, NE, TAKE SPECTROSCOPE, SW, THROW SPECTROSCOPE. ....we wake up and our mother tells us that it was all just a bad dream, well it kind of fits.

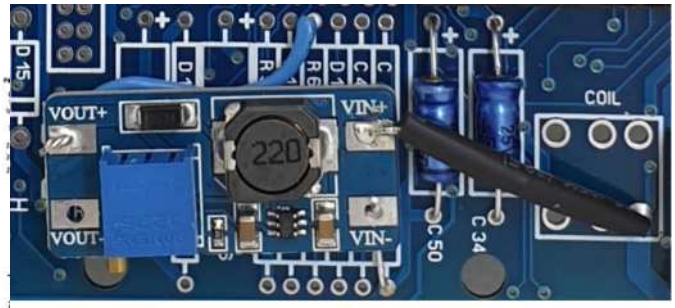
Now everyone can make his own impression of this program. For me it means at this point to keep an eye out for a new hopefully more challenging adventure. Let's be surprised.

Harald Lack

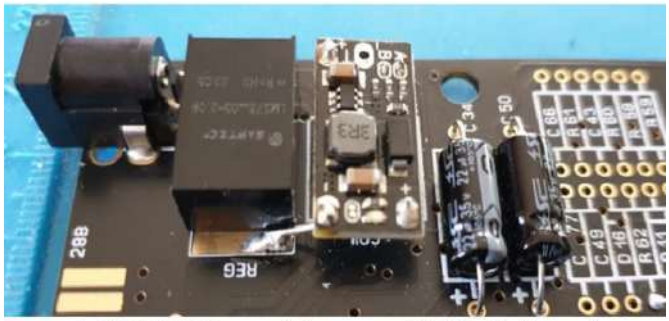


ALTERNATIVES FOR THE POWER SUPPLY ON THE ZX SPECTRUM BOARDS AS OF ISSUE 3

BY BURKHARD TAIGE



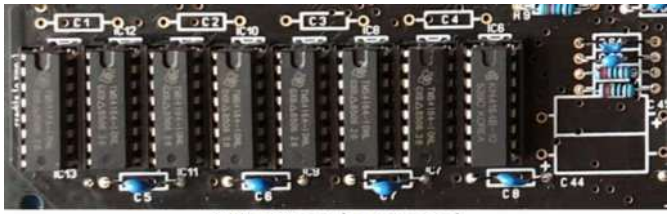
An MT3608 module on an ISSUE 3b board



A CKCS BS01 module on an ISSUE 3b board

On the ZX Spectrum, hardware defects often occur in connection with the power supply circuit on the board. The structure of the 12V and -5V voltage is on the one hand not short-circuit proof and on the other hand not designed for large loads. In case of an accidental short circuit at the expansion connector, which can already occur when plugging interface modules, the transistors TR4 and TR5 can be destroyed. In most cases, one or the other RAM IC of the so-called "lower RAMs" will also be destroyed.

The Portuguese TIMEX TC2068 does completely



C1 to C4 can be removed

without a -5V voltage. However, lower RAMs of the type 4416 are used there instead of the "Sinclair"-typical 4116. Since the 4416 are 18pin and not 16pin like the 4116 and therefore not "pin compatible", they do not fit for an original Spectrum.

But during my internet research I found a solution how to use the also 16pin RAM's of the type 4164: Pin 1 of the 4164 must not be used and pin 8 must be connected to +5V. The +12V for the 4116 are connected to pin 8 in the Spectrum and pin 1 is connected to -5V there. The +5V are connected to pin 9 of the 4116. On the 4164, pin 9 is the address line A7, which is not used at all in the "lower RAM" area. Setting A7 to +5V on the 4164 would only mean that a memory bank is defined. So you would have less than the 64K available, which would still be more than the 16K of the 4116. So the solution to using the 4164 is to not use the -5V and +12V and connect pin 8 to pin 9.

The advantage with the 4164s is that they are nowhere near as sensitive as the 4116s. Instead of the 4164 you can also use RAM-IC of the type 41256. So here you have the possibility to use what is available at the lowest price. (I had for example an old PC-ISA plug-in card with several 41256 RAMs in my tinkering box).

Switching voltage regulator and mini step-up module on an Issue 3b board

If you look at the schematic of a ZX-Spectrum, you only have to omit (or remove) the components around TR4 and TR5 to switch off 12V and -5V.

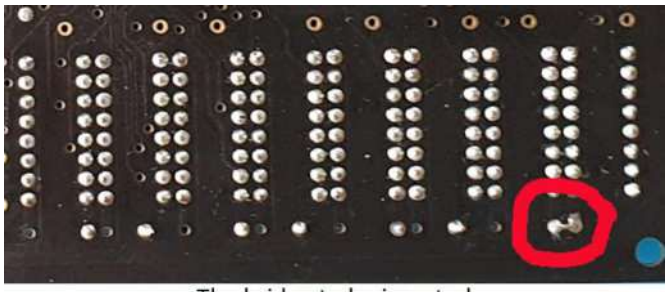
It could be so easy, if it wasn't for the video IC LM1889. This needs a voltage of +12 to 18V.

But now there is a relatively simple (and cheap) solution:

Once the "superfluous" components have been desoldered, you have enough space to install a "step-up module", based on the MT3608 chip, with three solder connections on the ZX-Spectrum board.

You can get a so called MT3608 DC-DC adapter or the smaller mini step-up module "CKCS BS01" at "Arduino accessory dealers" for about 5,-€.

While the bigger module has to be set to 12V output by a rotary control, the small module is set with two solder bridges on the mini board. Since the mini modules are shipped with 5V preset, the solder bridges have to be set, being very careful not to destroy this board.



The bridge to be inserted

For module installation: one of the minus terminals must be connected to a ground point of the ZX-Spectrum board. VIN+ is connected to the positive pole of the voltage socket. A suitable soldering point for this can be found, with the coil removed, on the upper right (facing the outside of the board) pin receptacle of the coil. VOUT+ must be connected in such a way that a connection to the video IC is made. The appropriate soldering point for this would be where R62 was originally installed, namely the left (towards the center of the board) connector.

n this context, the 7805 voltage regulator should best also be replaced by a switching voltage regulator. This reduces the power consumption, but more important is that no heat sink has to be installed, because this regulator does not produce any heat to be dissipated.

Switching voltage regulator and mini step-up module on an Issue 3b board.

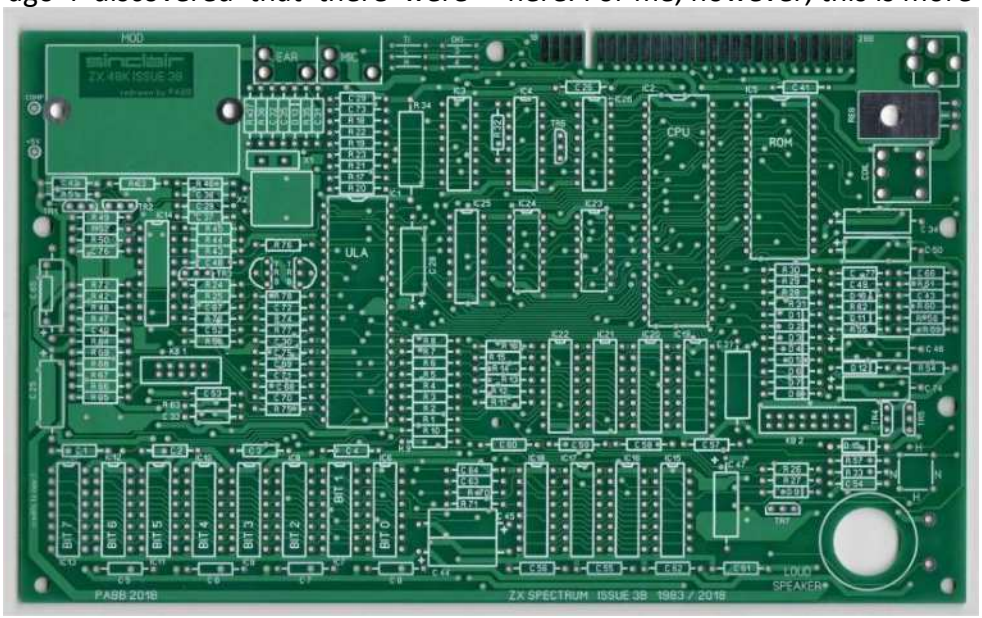
Finally the 4116s have to be replaced. Basically IC sockets should be used.

On the bottom of the board, make a small connection from IC13, pin9, to IC 12, pin8. With this, all A7 connections are then set to +5V and pin 8 is thus also at +5V.

REBUILDING A ZX SPECTRUM 48K, PART 1

BY BURKHARD TAIGE

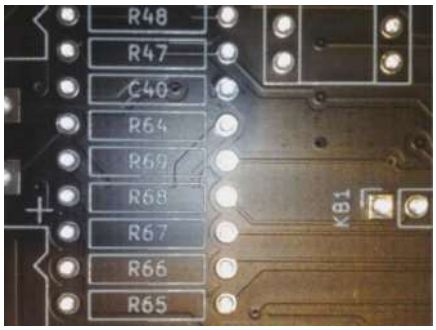
A few years ago I discovered that there were offers of defective Sinclair computers on the well-known auction platform. Until the Brexit it was still possible to get cheap spare parts and used empty cases from the UK. But because of the high shipping and customs fees, buying there is hardly worthwhile anymore.



I still had a few spare parts lying around, so I tried to buy the one or other "defective" Spectrum at auction.

Meanwhile, in the EU area, where the shipping costs are still reasonable, real collector's prices are demanded. Such a "defective" ZX-Spectrum often goes for 100,-€ and more to the successful bidder. For the repair you have to calculate a new keyboard foil (about 20.-€) and then there can be a lot more defective parts. Since many parts of the ZX-Spectrum are no longer manufactured, higher "collector's prices" for used (and often not tested for function) spare parts are coming up. If you try to sell the restored ZX-Spectrum at an auction, you will be disillusioned: there are hardly any bidders who are willing to pay more than for a "defective" Spectrum. So there is no business idea here. For me, however, this is more of a hobby. If I actually offer such a former "electronic scrap" for auction again, the minimum price is based on my own cost i had for the spare parts.

With the auctioned "untested" Speccy's it was often a horror scenario, if a previous owner with ignorance dared to repair. Often the original board was "tinkered". Because the thin conductors quickly come loose when components are pulled out of the board or when soldering in IC sockets, conductors under the sockets are damaged (cut or short-circuited). If the board is not salvageable at all, you can salvage the special components that may still be intact (ULA, power supply coil, ROM IC, modulator, case). However, you won't find original boards without components.



Now and then you can find replica boards, which are more or less similar to the original.

The probably best known replica board is based on version 3B

Issue 3b (PABB 2018) is a copy that follows the original very closely.

It was rare to find the version 4b as a replica.

This circuit board 4b does completely without the installation of the modulator. Directly on the board is an RCA jack for the composite video output. A great approach, because on most Speccy's the UHF modulator is modified by a composite video output. However, for another reason, this board is not functional this way!

Between resistors R69 and R68, the trace extends into a closed area. In fact, the area up to the top of R68 is the trace for +5V and the part below R69 is the trace for the common ground. Finding this defect was quite a challenge. The seller did not know about this defect and so I had to search for hours until I found the shortcut. A cutter knife was then used to solve the problem.

So if you dare to do such a project yourself, you definitely should have the circuit diagrams and a multimeter, besides the soldering utensils. This "4b" board is not only critical because of the layout error, but also because of the very filigree solder joints, especially at the transistors.

Once it is determined that the board is error-free, it can indeed be used to create a working ZX Spectrum. However, the cost and the amount of work involved should make it clear that this will not result in a Spectrum at a "bargain price".

In the next articles I will discuss which components are especially critical for such a reconstruction. I.e. which special components of a Spectrum are needed, and which replacements can be found.

Burkhard Taige

REBUILDING A ZX SPECTRUM 48K, PART 2

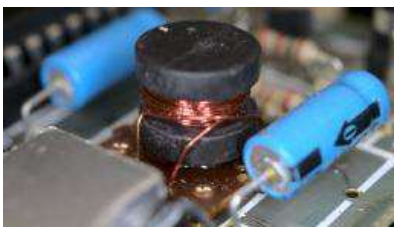
BY BURKHARD TAIGE

In the last article I reported about my start into the assembly of rebuild boards. Some used Spectrum's have been soldered so heavily that the "mainboard" can't be saved anymore.

To solder out all components from such a "worn out" board and transfer them to a new board is not recommended. Often transistors are already broken or components are so far aged that they are simply useless.

Important are the following components, which have to be soldered out very carefully, or, if they are plugged into sockets, carefully levered out.

1. The ULA-IC - a very specific circuit that controls the input and output of the signals. For the common ISSUE 3B board it must be a ULA 6C001E-6 or 6C001E-7. For the ISSUE 4B and higher, only the 6C001E-7 will work. All "5C" ULA's from Issue's 1 and 2 will not work for the replica boards.
2. The transformer coil (Coil) in the power supply section.



3. The Sinclair ZX Spectrum ROM-IC. Here, however, an EPROM can be used, provided the utensils for programming are available.
4. The UHF modulator.
5. The loudspeaker (is hard to find as spare part with the required specifications).
6. The keyboard connector sockets (but can still be found new in the internet trade)
7. The EAR- and MIC- and power connector sockets (these can also still be found in the trade)

All other components are either too fragile to be soldered out and back in, or getting new ones is not a problem.

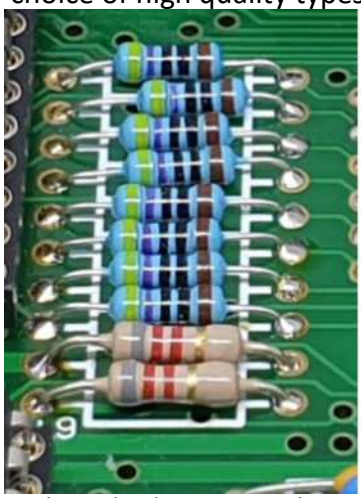
The resistors are penny items and are basically available.

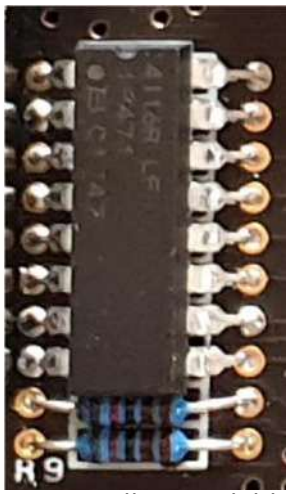
You can think about whether to use cheap carbon film resistors or slightly more expensive metal film resistors. I chose mostly the metal film variety because tolerances of 2% are required in some cases. All resistors are 1/4 watt types, only resistor R34 (15 ohms) is to be a 1 watt type.

Alternatively, "arrays" can be used in some places.

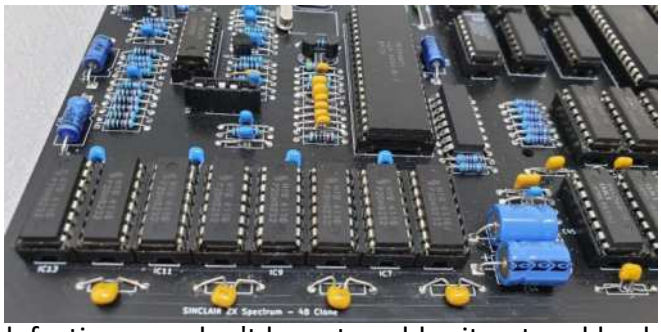
The capacitors (ceramic or multilayer types with 5% tolerance) are actually no longer available in the ideal form (axial) for the board assembly. The connecting wires have to be bent accordingly. Here, too, you will only encounter problems with the 16pF capacitors for the 14 MHz crystal, but also 15pF or a 15pf with a 1pF capacitor connected in parallel will work.

The electrolytic capacitors age over time and are the biggest problem on the ZX Spectrum. The cheapest electrolytic capacitors will last about 2000 hours of operation. However, there are also electrolytic capacitors available that should last up to 10000 hours. With the few electrolytic capacitors, which are installed in the Spectrum, the additional expenditure of a few cent per electrolytic capacitor can be neglected. It only gets special if you are looking for axial types (which can be installed best on the board) - there is no more choice of high quality types.





The diodes are also commercially available everywhere and should be soldered first on the new board. After that the next higher components, namely the resistors, then the capacitors and IC sockets. Yes - in principle, sockets for the required IC's should definitely be soldered in. First, you avoid overheating these components during soldering and, if an IC turns out to be defective, you don't have to solder it out and back in again.



Most of the transistors used in the original are no longer produced. For this, however, partly even better replacement types are available.

The voltage regulator IC µA7805 is still produced, but I would always advise to use more modern switching regulators. Due to their switching characteristics, these regulators do not heat up as much as the 7805, which absolutely needs a heat sink for heat dissipation.

When using a switching voltage regulator, the heat sink is omitted. As a result, the case does not get as hot. However, these regulators are about 5 times more expensive than a 7805 ...

By the way, if you really value a 7805, you should rather go for the 78S05, because it is designed for currents up to 2A, while the 7805 can only handle 1A. When connecting peripherals to the expansion connector, the total current can actually reach almost 1A, which makes the 7805 "sweat" quite a bit ...

The crystals and 74LS IC's are unproblematic to get, also the Z80 CPU is still manufactured, i.e. the more power saving CMOS variant Z84C00 is offered. Using a CPU with a higher clock rate is not critical, especially since 10MHz types are often cheaper than 6MHz types. The video circuit LM1889 is much harder to get and often relatively high prices are asked for it. It is especially difficult to get a working original ULA device. This IC is no longer produced. Also the RAM IC are only available used or as "new recycled" from China.

More about this and possible alternatives in the next article.

Burkhard Taige

THE I2C BUS ON THE ZX SPECTRUM AND ITS APPLICATION

BY HEINZ JUNEK, JUNE 17, 2022

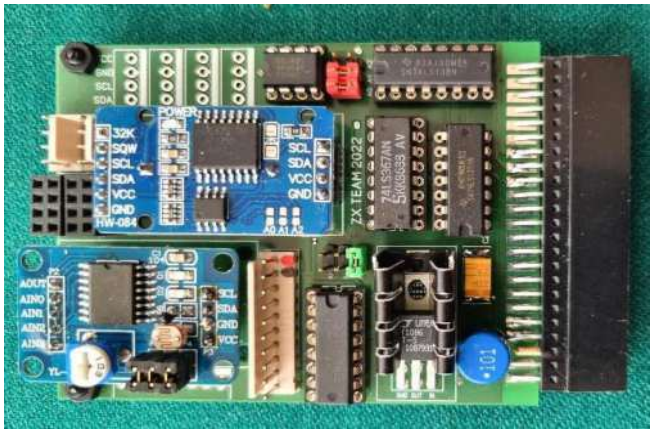


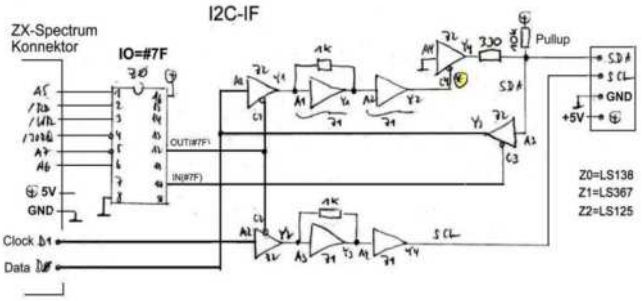
Fig. 1: A ready I2C interface

The ZX Spectrum has only a rather sparse number of free IO addresses for connecting further peripherals. Actually, only the eight addresses XXX1|1111 are freely available. The control of a larger railroad system is therefore out of the question. A way out is the use of the I2C protocol. With this, eight or more additional addresses per IO address of the ZX Spectrum are easily available. Practically up to 64 locomotives could be controlled. I want to introduce the system briefly. The I2C protocol was introduced by Philips Semiconductors in 1982. The name I2C is the abbreviation of Inter-Integrated Circuit. Atmel uses the same protocol for licensing reasons under the name TWI (Two-Wire-Interface). So I2C has a two-wire line (SDA, SCL and of course GND) to which the external I2C modules are connected in parallel. Each of these modules has its own seven-bit address, of which four bits are hardwired inside the module, and three other bits (called A0, A1, A2) can be freely selected. All of the connected modules (called slaves) "listen" on the SDA line and become active when their address is called by the computer, called the master. This master also sends a clock signal on the SCL line as a clock for the serial data transfer. A little more info about the I2C protocol is needed: The following signal sequence is sent:

Start bit - address byte with read/write bit - acknowledge bit (ACK) from slave - one or more data bytes (from master to slave or vice versa) - acknowledge bit from master or slave - stop bit from master.

After that SDA and SCL are at HIGH level again. Now here is a circuit for an I2C interface which will run in this way on the ZX Spectrum, ZX81 or Jupiter ACE.

Our ZX-Team friend Waldemar has provided some boards made after this circuit recently. At the same time he added more sockets for different I2C circuits directly on this board. Among



The circuit requires before read commands or before ACK vo slave at H, so OUT (#7F),%000001, then out(#7F),%0000011 and IN A, (#7F)

Fig 2: Circuit diagram

them an 8-bit expander, a clock, an AD converter and a thermometer. In fig. 2 you can see the realization. You can see that a ZX81 connector is soldered on. But since the required lines are identical on the ZX81 and ZX Spectrum, the board can easily be connected directly to the ZX Spectrum. Good news: Waldemar can still deliver one board.

The I2C protocol is generated by software. Since the data transfer is synchronous by means of a clock signal SCL, the data rate is not time critical. Therefore a pure BASIC program is sufficient for first attempts. The following is a listing for it. The program tests all possible I2C addresses and queries the confirmation messages. If an I2C module exists under the corresponding address, a long BEEP occurs and the address is written to the screen. By suitable extension of the program according to the described pattern (GOSUB 500: GOSUB 600: GOSUB 900: GOSUB 800: GOSUB 700) the complete communication with connected I2C modules can be done. Here at first the complete CHECK program.

```
100 REM I2CCHECK
106 DIM Y(8)
108 CLS
110 PRINT "AKTIVE ADRESSEN"
120 FOR A=0 TO 255 STEP 2
122 PRINT AT 0,20;"CHECK ";A
125 LET X=A: GO SUB 500
130 GO SUB 600: GO SUB 900: GO SUB 800:
    GO SUB 700
135 IF Z=0 THEN  BEEP 0.2,10: PRINT A
140 NEXT A
150 STOP
160 REM ******
500 REM Conversion X to 8bits Y()
510 FOR I=1 TO 8: LET X1=INT (X/2):
    LET Y(I)=X-2*X1: LET X=X1: NEXT I
550 PRINT AT 1,22;: FOR I=1 TO 8:
    PRINT Y(9-I);: NEXT I: PRINT
560 RETURN
600 REM START
```

```
610 OUT 127,3: OUT 127,2: OUT 127,0
620 RETURN
700 REM STOP
710  OUT 127,0: OUT 127,2: OUT 127,3
720 RETURN
800 REM SLACK
810 OUT 127,1: OUT 127,3: LET Z=IN 127:
    PRINT AT 2,22;"Z=";Z;" ";: OUT 127,0
815 LET Z=# Z-2*INT (Z/2)
820 RETURN
900 REM SEND X or Y()
910 FOR I=1 TO 8
920 OUT 127,0: OUT 127,Y(9-I):
    OUT 127,2+Y(9-I): OUT 127,0
930 NEXT I
940 RETURN
```

I2C modules are available for a few "Eurons", and it's a lot of fun to play with them. Let's have a quick look at the four modules on Waldemar's card.

THE 8-BIT EXPANDER PCF8574A (THE A IS IMPORTANT!).

This is a simple module that can be used to input or output a data byte. Herewith a traffic light control or also the communication with other hardware is very simple possible. The device address can be taken from the data sheet of the chip: It has the form 0111|A2|A1|A0|Z. The first four bits are fixed. A2,A1,A0 are pin designations. These pins can be connected to GND or Vcc, and this results in the other three bits. On the board, these pins are routed to jumpers, so there is some address selection. By default, 011 is plugged in. The bit Z=W//R determines whether writing (Z=0) or reading (Z=1) is to be done. For the output of a byte this results in the address 0111|0110bin = 118dec. Now how is a byte, say DATA, output? As described above, it is done as follows:

Start bit (GOSUB 600), address output (LET X=118, GOSUB 500 and GOSUB 900) , Slack (GOSUB 800), data output (LET X=DATA, GOSUB 500 and GOSUB 900), Slack (GOSUB 800), Stop (GOSUB 700).

Now connected LEDs should light up according to the binary structure of DATA. If you want to read from the port, the address is now 0111|0111=119dec instead of 118. And instead of the output of DATA, the program must be completed by the following READ routine.

```
1000 REM READ
1010 LET X=0
1020 FOR I=0 TO 7
1030 OUT 127,1: OUT 127,3:
     LET Z= IN 127: OUT 127,1
1040 LET Z=Z-2*INT(Z/2)
1050 LET X=2*X+Z
1060 NEXT I
1070 RETURN
```

The variable X contains the result and can be output with PRINT X.

THE DS1621 TEMPERATURE MODULE.

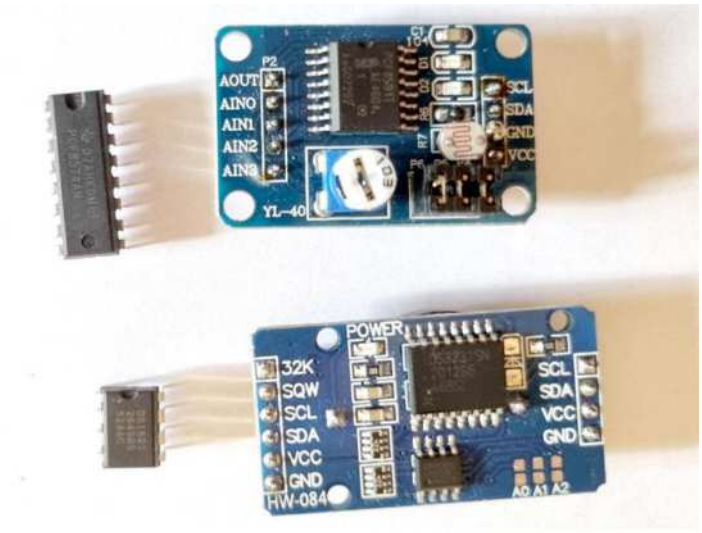


Fig. 3: Some I2C modules

This module is a digital thermometer and at the same time a thermostat. The base address is again taken from the manual, namely 1001|A2|A1|A0|0. Reading in is again done with GOSUB 1000.

THE AD/DA CONVERTER 85911.

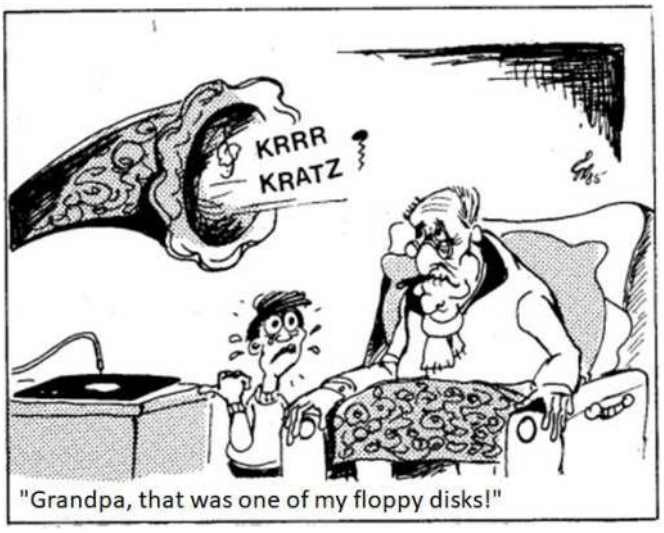
This module is an 8-bit AD/DA converter with three input/output channels. Additionally there is a thermo and a photo resistor on the board. So you can measure temperature and brightness. However quite inaccurate.

THE DS3231 - A RTC CLOCK MODULE.

This module provides a date and time announcement. It has a CR2032 battery, so that the time continues to run even after the module is switched off. Setting date and time is of course also possible with a write process.

The number of simple I2C modules is huge, there is something suitable for all fields of application. It is a lot of fun to experiment with them! Dare!

Finally I would like to thank our ZX-Team friends Joachim and Waldemar for many discussions, valuable tips and the production of the hardware.

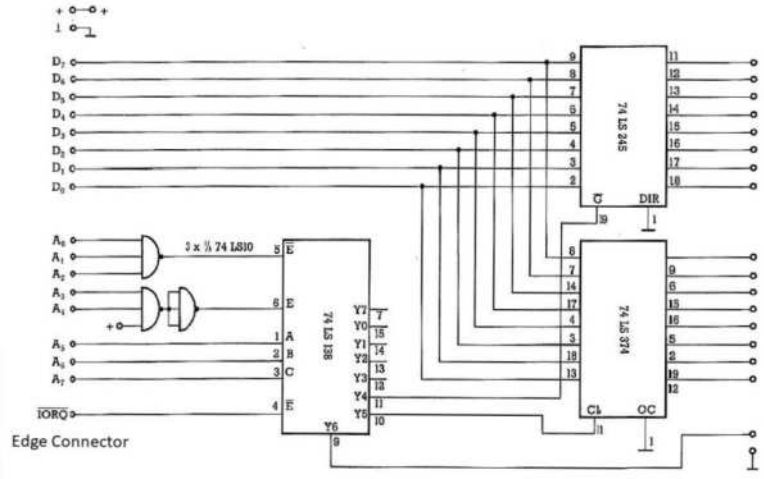


DISCRETE PIO FOR THE ZX SPECTRUM 48

BY JOACHIM GEUPEL

Discrete PIO plugged onto the breadboard by Ben Versteeg

Most of us will remember the magazine Happy Computer - at least those from the western part of the republic. But I can imagine that a not inconsiderable number of this magazine also made it to the GDR. The good times of the ZX Spectrum were actually over by January 1986. But that didn't stop the computer magazine Happy Computer from publishing another construction manual for the ZX Spectrum. The "cheap PIO" was not only suitable for the Spectrum, the circuit could also be used for the ZX 81. I rebuilt and tested this PIO. The circuit was designed by Nils Koerber, not to be confused with the soccer player of the same name from Herta BSC, who probably has no idea about electronics. Nils Koerber also designed other circuits for other computers for Happy Computer.



First of all: the Discrete PIO is really very easy to rebuild. The simple circuit consists of only four ICs. I modified the circuit a little bit and added an IC, which is admittedly only a gimmick and I added it because I still had space on the board. But more about that later.

DESCRIPTION:

The PIO, as just mentioned, consists of only four components. It provides two 8-bit ports, of which eight bits each serve as input and output. In the original circuit, the PIO is used as a parallel port to control a Centronics printer, so one pin of the address decoder is used as strobe and another one as busy. I did not test this.

Two 28-pin headers connect the board to the ZS Spectrum Expansionport.

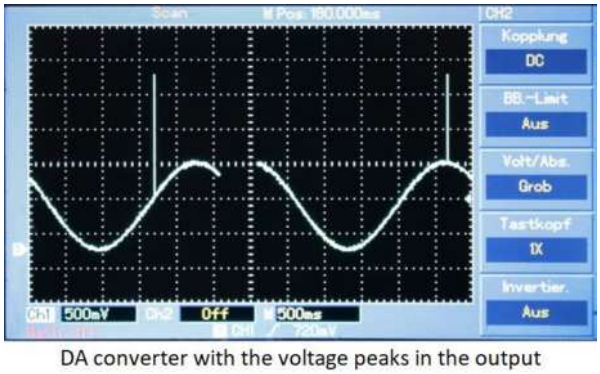
The 3-NAND 74LS10 are connected to the 1-out-of-8 decoder 74LS138, to form the address decoder;the address 191 for output and 159 for input are decoded. Contrary to expectations the bus driver 74LS245 is not used for output but for input. The 74LS245 is a bidirectional bus driver, which can pass applied data in two directions. Pins 2 to 9 form the A-side of the driver, pins 11 to 18 the B-side. Pin 1 is connected to GND, this enables data passing from B to A through the IC. The IC 74LS374 is a latch which latches the applied data from the Spectrum and outputs it only when the read-command comes from the Spectrum.

The address lines A0 to A4 lead to the 3-NAND 74LS10. A5 to A7 lead directly to the 1-out-of-8 decoder 74LS138. The value applies here to inputs A0 to A2 leading to the enable inputs. When EN is HIGH and EN2 and 3 are LOW, each switches one of the outputs Q0 to Q8 to low. EN2 is connected to the IO request of the Z80. So the decoder 74LS138 is not enabled until the Z80 agrees with it.

THE PINS

The address applied to the decoder along with the IORQ selects either the 74LS245 for data input or the 74LS374 for output. The 74LS138 decoder has eight outputs, only two of them are used directly. Theoretically, eight inputs or outputs can be decoded and the IO port can be extended accordingly.

REPLICA



DA converter with the voltage peaks in the output

The rebuild was not critical for me, because i was able to have a board professionally milled. Also, I actually made it easy for myself and designed the board so that I could plug it onto ByteDelight's breadboard. The breadboard has the advantage that the Edge Connector is led out on two socket strips, which are located to the right and left of the patch panel. All bus signals routed out on the Edge Connector are thus easily accessible and just as easy to re-measure.

I added a few extras to the PIO. On the board there are eight LEDs, an eight-pole DIP switch and two ten-pole single row socket connectors. The LEDs show the output data and with the DIP switch data can be entered directly. A reset circuit, which is actually superfluous, resets the Spectrum when a pushbutton is pressed. The button applies a TTL-high to the trigger input of an NE555, whereupon its output generates a short pulse. This pulse switches a transistor, its collector is pulled to LOW and causes the Spectrum to reset.

The board was created with the free version of Target 3001! Why? Because I know how to use it and KiCad does not work properly on my computer with Windows 10.

THE PROGRAMMING

The programming is very simple. With OUT 191,(number) a bit pattern is output, with IN 159 a binary value is read in. The number range is from 0 to 255, so there are only 8 bits available.

TEST

Successful test of the output

Of course, I tested the PIO extensively. Both the output and the input worked immediately. Random values of 8-bit numbers were output to the LEDs, as well as the switch positions of the DIP switch were displayed on the screen. However, my original wish to build a digital function generator based on the Spectrum had to be put out of my mind. The operating speed of the Spectrum is so slow that the fastest signal I could generate was slightly faster than 64 Hz. Accordingly, the result was the same with the DA converter I connected.

In the depths of my collection of electronic components I found a DA converter ZN426E. This converts the binary numbers into an analog voltage value between 0V and 5V. The DA converter produces an analog signal that can either be displayed on an oscilloscope or measured with a multimeter.

LIMITATIONS

The cheap PIO only works on the Spectrum 48 and the Harlequin 48. All other ZX Spectrum, i.e. Toastrack, Spectrum 128A & B, Spectrum +3 and Spectrum Next do not work. I have not tested the various clones that exist.

On the Spectrum 48 and the Harlequin, a strange phenomenon appears during output. In irregular intervals a 255 is output. The connected LEDs therefore light up briefly at irregular intervals.

With the DA-converter all possible signals can be generated, of course in ZXS48 speed. A list of values, which actually represent a nice sine, generates exactly this with a frequency of about 0.5 Hz. This sine is overlaid by the irregularly output 255 and shows jumps to 5V, which actually don't belong there. In contrast, the input of 8-bit values works without problems. The circuit with an 8-bit AD-converter is currently in work.

CONCLUSION

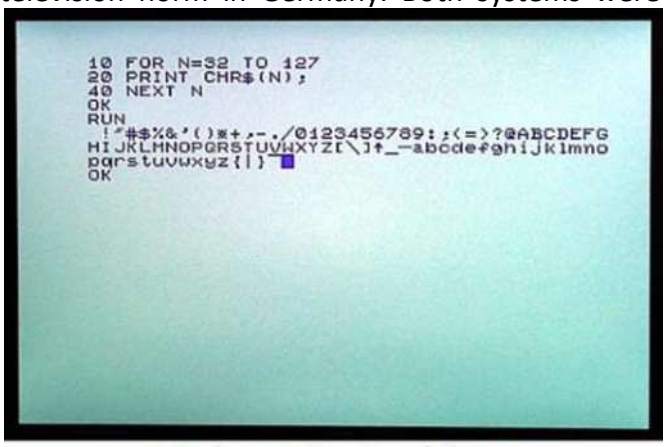
The cheap PIO is fun, as long as you can get along with the error described above. The circuit is easy to understand and can be rebuilt without problems. I will play around with it some more, maybe control a stepper motor or detect the air pressure via a sensor. Not because I need it but because it interests me. The way is the goal. I have enough ideas.

The total work of art:
PIO, ZX-VGA, DivMMC - all mounted on the ProjectSPECCY backplane.

RETRO FROM FRANCE:
THOMSON TO7 SERIES
BY JOACHIM GEUPEL

The THOMSON TO7 was a computer from France, which was sold by the THOMSON-BRANDT group from November 1982 to June 1984. Its distribution in Germany was very small and probably limited to the border area Germany shares with France. The computer is 100% French. Because of this and its educational software, it gained strong popularity almost exclusively in France. In June 1984, the TO7 was replaced by the TO7-70, which matched in large parts with the TO7 and had a real keyboard instead of a membrane keyboard.

The computer is built around a Motorola 6809 processor clocked at 1 MHz, has a 6kB ROM with the loader routine for the module basic and all the I/O handling of the computer including the light pen. The RAM Size 22 KB was a bit smaller than compareable computers with this configuration. Video output is to a monitor connected via SCART or to a TV via an external RF modulator. The RF modulator was produced for at least two television standards. In France, SECAM was the standard television norm, while PAL was the valid television norm in Germany. Both systems were



Microsoft Basic on TO7

and are not compatible with each other.

The keyboard is partially similar to that of the ZX81. Likle the ZX81 membrane Keyboard, it is similarly difficult to use and does not allow advanced typing speeds. Each keystroke is accompanied by a short beep. Some models have a bulky cooler on the back, which gets hot after a few hours of use.

The optical pen or Lightpen, is included as standard in the configuration and is permanently installed in the computer via a coiled cable.

In late 1983, a package was offered for sale, including:

- The THOMSON TO7
- The extension "Music and Games"
- a pluggable sound management box and two joysticks with DIN plugs,
- The Microsoft BASIC cartridge with MS-Basic 1.0,
- The Trap cartridge game, a 2D maze game, a kind of simplified Pac-Man,
- A graphics software on a Pictor cartridge, to draw on the screen with the optical pen,
- The user manual,
- A didactic and well-designed introductory book to BASIC.

At that time, as with most home computers, the most common medium for software was the audio cassette, so the purchase of a cassette player was mandatory. THOMSON offered its own cassette recorder, which, unlike its competitors, had the advantage that the data was transferred directly in digital form.

Later, other media gained importance, such as the QDD (Quick Disk Drive), a 2,8" disk drive developed by MITSUMI and available from several manufacturers. Some computers in the MSX series, as well as the ORIC computers, used this QDD.

Start screen with program selection

Program cartridges were needed to work with the computer. There were cartridges with game software, educational software, and of course the obligatory Basic that came with the computer. The Basic cartridge had to be slid into the lockable slot, which was located on the left third of the computer. After powering on, it booted to a splash screen where the Basic could be selected. eEther by entering the appropriate number or by tapping with the Lightpen, the appropriate program was selected. After the BASIC was loaded, the memory available for the programs was about 6 kB. To run some advanced programs like games, it was necessary to purchase an expansion module with 16kB plug-in, which increased the memory to 24kB. Another expansion, marketed by Peritek, allowed memory expansion up to 32kB.

Cartridge with Microsoft Basic 1.0

"TO" stands for "TELE-COMPUTER" because the device was intended for the family market and was connected to the TV in the living room, saving the purchase of a very expensive monitor.

The TO7 was an innovative device in 1982, designed to be compatible with MINITEL, the French BTX. Thomson had filed several patents covering graphic management, the MEMO7 cartridge, and the external floppy drive.

In Germany the THOMSON TO7 was relatively unknown and therefore found also hardly spread, particularly since the market was already occupied by computers such as the ZX SPECTRUM and the COMMODORE C64, and it had no chance against the announced 16-bit computers of ATARI, the APPLE MACINTOSH and the COMMODORE AMIGA. It was not powerful enough for that, despite its range of functions.

The THOMSON TO7 was replaced by the TO70-70 in 1984. The differences between these two computers are marginal: The processors are nearly identical: in the TO7 works a 6809, which allows a clock frequency of 1MHz, while the TO7-70 uses a 6909E, which can handle a maximum clock frequency of 2MHz but still operates at 1MHz. The TO7 requires an external RF modulator, can be upgraded to 22kB and has eight colors available, the TO7-70 has 48kB of memory which can be upgraded to 112kB. The RF modulator is built-in and it can display 16 colors. However, it must be noted here that there are quite different specifications on the various websites.

The series of THOMSON TO computers continued with the TO8 to the TO9 and in 1986 TO9 PLUS, this was a desktop computer with a Motorola 6809e processor, but could not gain a foothold, since the market was already dominated by the 16-bit computers and the DOS-compatible PC. The actual success remained denied for the THOMSON series, despite some quite innovative extensions.

NEXT BASIC - PART 3

BY CHRISTOF ODENTHAL

Here is the third part of Next Basic. This time it's about error handling, i.e. how to prevent a program from simply aborting in case of an error - instead it should find a meaningful continuation.

Error handling

First of all a warning if you play around with the following commands: Save your work regularly before starting, because it can happen that you can't abort your program afterwards! The "Break" key combination is also intercepted!

With the following command you define what should happen when an error occurs:

ON ERROR <Statements>

"<Statements>" can be several commands. The "ON ERROR" should be at the beginning of the program or at least before the command where an error can occur. In the case of an error the whole behaves like a GO TO; after an error the NEXT jumps directly to the commands behind the ON-Error command, like a GOTO-Statement, the program continues from this place further! Here caution is required, because you can get immediately into an endless loop! If you don't jump to another place by GO TO after the "ON ERROR", it can happen that the following faulty line is executed again and again! An example - you can't get out of this without a reset:

```
10 ON ERROR PRINT "Error! "
20 PRINT 1/0
Better would be:
10 ON ERROR PRINT "Error! " : GO TO 30
20 PRINT 1/0
30 PRINT "End."
```

A new "ON ERROR" statement (with commands following it) replaces the existing one. An "ON ERROR" without a following command (or directly followed by a " : ") switches off the error handling again.

Attention, the command "STOP" does NOT abort the program as long as an "ON ERROR" is active! If you want to abort the program with "STOP" you need the following commands:

ON ERROR : STOP

Display / query of the error

The command "ERROR" displays the last occurred error and aborts the program. For example:

```
10 ON ERROR PRINT "An error has
   occurred!" : ERROR
20 PRINT 1/0
```

But you can also find out exactly what happened and react accordingly:

```
ERROR TO errcode
```

or:

```
ERROR TO errcode, errline
```

or:

```
ERROR TO errcode, errline, cmdnr
```

This command stores the number of the error in the variable behind it. Optionally, you can also find out in which line and for which command. Instead of putting a separate "ON ERROR" in front of each line where an error could occur, you can also do a central error handling for the whole program this way. For example:

```
10 ON ERROR ERROR TO
   errcode,errline: GO TO 1000
20 INPUT "What is your name? ";n$
30 IF n$="" THEN GO TO 20
40 PRINT "Hello ";n$;" how are you?"
50 INPUT "And in which year were
   you born? ";y
60 IF y<1922 OR y>2021 THEN GO TO 50
70 PRINT "In the year ";y;"?"
80 IF y<=1982 THEN PRINT "Then you
   were ";1982-y;" years old when
   the ZX Spectrum came out!" : ELSE
```

```
      PRINT "Then the ZX Spectrum is";
       y-1982;" years older than you!"
  999 STOP
 1000 IF errcode=9 THEN ON ERROR : STOP
 1010 GO TO errline
```

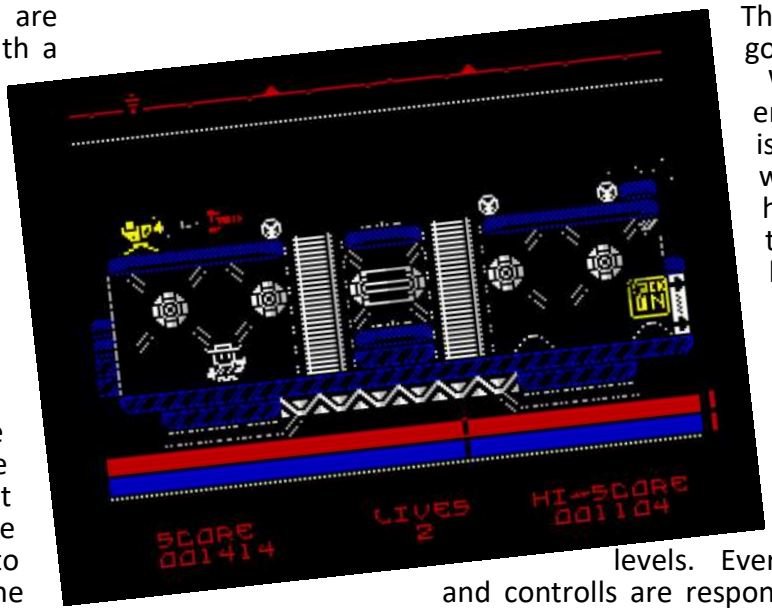
Line 10 makes the program jump to line 1000 for every error, even for the STOP command in line 999. In line 1000 the cause of the error is evaluated. If the reason was a STOP command, the error handling is switched off and the program is terminated. If not, then in line 1010 it simply jumps back to the place where the error occurred (this should be one of the INPUT lines, where the user probably made a wrong input).
You can try it once by starting the program and deleting one or both of the quotation marks when asked for your name - this usually results in an error! You can also enter letters instead of numbers in the question for your year of birth or a calculation like 1/0 - both would also lead to an error and program abort. In our case, however, the query is simply repeated!

LAST TRAIN TO TRANZ-CENTRAL

© 2020 BY QUANTUM SHEEP

REVIEW BY ELLVIS

I like trains. There is so much to do while travelling, they are comfortableand, with a bit of luck, they are also on time. Let's see how they will look like in the future.



We are a space cowboy hopping on the train that fly through the wast space of the universe. The problem is, that the AI that is in charge of the train went corrupted and the trains are heading to crash with the planets. So we have to find our way through the whole trains and stop the AI that is operating from the engine room. Are you ready? Let's go then!

I am not sure what the trains are delivering, but I'm sure that everything want to kill us. Rocket launchers, various creatures, just everything, good thing is that enemies are blinking, so we can be sure what is lethal for us. We can also shoot and don't have to care about the ammo. Not everything can be killed, but the gun is important, because we cannot jump. The only way up are ladders and that mean we will have to walk around a lot. Some train cars are straightforward, but some are not.

In each car we have to collect coins. Once we have all of them, we can proceed to the doors at the right side and enter another part of the train. There is 8 cars in 4 trains to go, so we won't be bored.

When we enter the engine room, the AI itself is blinking but is static and we cannot pass it. We have to shoot it so it start to float around. Then we have to run to the exit. After that we get the introductions for another train and things go on again.

The graphics are quite nice and simple. There are also some colours, more of them in later levels. Everything move smoothly and controlls are responsible. Sounds are sparse beeps but on Spectrum 128k we get a music for AY during the play. I find the game quite difficult. Having just 3 lives mean we cannot do any mistake. It need a couple of games to be able to reach other trains, but at the end the game is winable. If you are not sure if this game is for you, youcan download first part, which is completely free. Second part will cost you 1,99£. There is also physical version from Bitmapsoft.

Buy the game at:

https://quantumsheep.itch.io/last-train-to-tranz-central

or physical version at:

https://www.bitmapsoft.co.uk/product/last-train-to-tranz-central/

GAMES 2020

Hello everyone,

since Ellvis ran out of time this time, I'm partially taking the helm for this issue and the game reviews. But I have help, Ellvis wrote two tests and some I got from Jungsi.

In general, looking back, I can say 2020 wasn't the strongest year, but it's getting better, there were some hits again in 2021. But back to where we were, so we start in 2020:

»TRANSYLVANIAN CASTLE«
© 2020BY FITOSOFT (FITO, SIYEI-ER)
REVIEW BY ELLVIS

Once again I get to the conclusion, that trying to pick-up interesting games and not looking also at the ones with a basic graphics is a mistake. Let's visit an unknown castle in Transylvania. I am a big fan of RPG games, but I just don't have enough of time to play them. That's exactly why I tried this game; it look very basic and I was not expecting anything interesting. But you know what? It's quite a long time already and I am still there, lurking inside of this mysterious castle and exploring it's secrets.

The game mechanics are very simple. Once we enter the room, we can do just few things. If there is a monster, we can attack it (pressing the direction where the monster is). If we killed the monster and there is something left behind, we can pick it up (pressing space). We can carry 3 objects plus we can have one object in each hand. Once we are done in the room we can leave it pressing the direction where exit is (up or down using ladder, left or right using doors). And basically that is the game. The aim is to find a key and escape the castle.

The objects in the game are of 3 different types. First ones are different weapons like, axe, sword, bow. When we use them (pressing key 1 to 3 depending on which possition the weapon appear), they will automaticaly move to the right hand (this also mean we can use just one at a time). Then we have a defence object like a ring or shield, these go to the left hand if we select one. And then there is very important stuff as food and potions. These will be used directly and recover our energy.

The fights are turn-based. We always see how successful the attack was and what is our remaining energy, so we can act upon that. It is possible to leave the room during the combat, but when we come back the enemy will recover to it's original strength. Most enemies are easy to defeat, but there are some (mostly on the higher floors) that are much stronger then us. We have to train our hero a bit to reach higher levels and just after that we can move on to kill the strong beasts. Also, the map is being generated every new game, so you can come back to the game even if you won already. If you like this kind of games, you should try also this one. It may have just a simple graphics (UDG) and few beep sounds, but it's simple to start with and a real fun. So, will you escape the castle?

Download at:

https://siyei-er.itch.io/transylvanian-castle-deluxe?download

»YOYO'S GREAT ADVENTURE«
© 2020 BY RAFAL MIAZGA
REVIEW BY ELLVIS

When you play with magic and something bad happen, it is mostly your fault. But who to blame if magic strikes you out of nowhere? Well, let's find out in this nice little adventure.

Yoyo is living in a magical land with his friends, but all change when he is suddenly teleported into unknown land (well, it look like it's a medieval Poland). Luckily the land is not deserted and he try to ask for help. And here we are, a Dizzy-like adventure where local creatures will help us in "do me a favour first" manner. And I have to say that it is not a bad adventure!

So, at first we meet a priest, who is capable of some magic. Once we find his amulet (and fix the bridge to do that), he create a wormhole (well, how would you name it in the old times?) to help us. But as we will find out pretty soon, the destination is not the one we want. So we move on and collect more objects, talk to more creatures, solve more puzzles.

Yoyo can carry 2 objects at the same time. He have 3 lives but each life has also it's own energy meter, so if you touch something dangerous, you have the time to escape. This doesn't apply allways, the angry bear or bull are not your friends and will not let you escape at all. The same thing apply for water - Yoyo is not a good swimmer so take care!

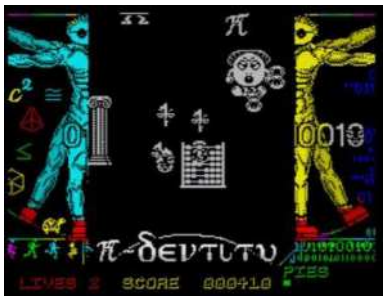
The game look nice. Graphics are colourful, everything move very smoothly and the controls are just right. To solve puzzles, we usually have to walk a bit around, so it may come a little bit boring to see screen many times before completing the game, but that is a part of this kind of games. Puzzles themselves are logical, although I was a bit stuck once I traveled to the other lands with priest's help. But don't be desperate, there is always a solution.

If you run the game on Spectrum 128k, you will get a nice AY music during the play. Besides that the game contain just few beeps here and there, so the music is a good thing. Overall, I enjoyed playing this game, it's slow paced and you don't feel a pressure to move things on fast. If you are looking for a bit of relax together with some brain activity, Yoyo's Great Adventure can be right game to play.

Download at:

https://spectrumcomputing.co.uk/entry/36519/ZX-Spectrum/Yoyos_Great_Adventure

»PI-DENTITY«
SEBASTIAN BRAUNERT ET AL.
REVIEW BY JUNGSI



PI-DENTITY comes from none other than the father of "TEAM MORITZ", which can always be blamed for new games for the ZX Spectrum. PI-DENTITY is a Shoot'em'Up, which was developed with SEUD (Shoot-Em-Up-Designer). It was also part of the FUSION-MAGAZINE (Chris Wilkins) Kickstarter campaign, through which I came into possession of the cassette version, which also includes the 128K version of the game with AY music.

In the once again wacky story, the hero is not the author's dog - MORITZ - but the number PI. So, even in the world of numbers, there are problems that need to be shot down, one of which is Einstein. When the trigger of the gun has been pressed for this purpose, the number 3.14 appears to finish off the enemies, which cost one of the nine lives when touched.

Ammunition is limited, but can always be refilled in the form of a "pie". The infinity symbol shouldn't be overlooked in all the hustle and bustle, as it gives immunity from enemies for a few seconds.

The sprites are really funny, with all the nonsense somewhat reminiscent of Monty Python. Unfortunately, the game is not very colorful and there are only three levels available, which cannot be avoided due to the limitations of the SEUD engine. PI-DENTITY certainly can't keep up with great shooters like TERRA CRESTA, which wasn't intended, but it can definitely entertain for some time.

Download at:

https://spectrumcomputing.co.uk/entry/35772/ZX-Spectrum/Pi-Dentity

»BLACK AND WHITE«
ANTIONIO PEREZ, JARLAXE (GREENWEB SEVILLA)
REVIEW BY THOMAS

The structure of the game reminds me of **BUBBLE BOBBLE**, but it quickly becomes apparent that the main character lacks an important feature: he can't jump. The enemies can also only be paralyzed for a short time, but not destroyed. So you get through the level by dropping, if you are at the bottom and fall again, you come out at the top of the screen. All diamonds must be collected and ball of the same (black) color must be destroyed. What sounds simple, just requires some strategic skill, especially if you fly down a little longer. Otherwise, it is a nice well-made game with many levels for long entertainment. The graphics are definitely in the upper range, during the game you can hear a nice AY melody and at the beginning of the game you are greeted by the Spectrum version of the Michael Jackson hit "BLACK OR WHITE". After all... the whole thing is in color.

Download at:

https://spectrumcomputing.co.uk/entry/35121/ZX-Spectrum/Black_and_White

»GODKILLER - NEW TIMELINE EDITION«
APSIS
REVIEW BY THOMAS

Here it is, the new version of **GODKILLER**. I can't remember the predecessor anymore. In this game you run through a maze that looks a bit more futuristic than the one from Sabre Wulf, but it remains a maze and therefore a game principle like I've seen it ...yawn.... 1 million times or more. You run through, shoot enemies and collect items. I didn't see any new idea in the game here. But judged purely on a technical level, it's well done. The characters move reasonably fast, the graphics are colorful and lavish, and there's a somewhat gritty sound to go with it. I can't find anything bad about the game, I'm just tired of this gameplay principle.

Download at:

https://spectrumcomputing.co.uk/entry/36072/ZX-Spectrum/Godkiller-New_Timeline_Edition

»MORITZ ON THE AUTOBAHN«
SEBASTIAN BRAUNERT
REVIEW BY THOMAS

A game from Germany, the adventures of **MORITZ** we also previously presented here in this section. In this game **MORITZ** has to travel around Europe in his bouncing car and collect hearts everywhere. With that the traffic lights turn green and he can continue to race. In principle everything is known since **MINER WILLY**. What's new here are some nice ideas, like a stop sign you have to stand in front of until it disappears. In the end not bad, because there is no time limit. However, we are used to more elaborate graphics, but there is

something for the ears. The AY song may not be the best sound ever, but it's long and varied, and when you've lost, you're still rewarded with a digi sound. No idea what happens when you reach the finish. Maybe this should motivate you.

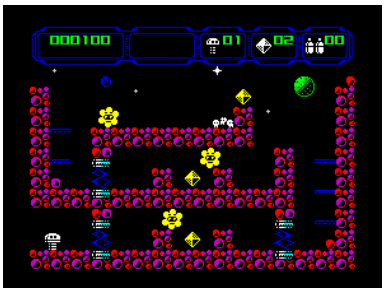
Download at:

https://spectrumcomputing.co.uk/entry/35328/ZX-Spectrum/Moritz_on_the_Autobahn

Or even for sale at Sintech (Spectrum cassette or CPC disk):

https://www.sintech-shop.de/moritz-on-the-autobahn/a-10792

»SPRINGBOT - MARS ATTACKS!<<
ANDY FARELL
REVIEW BY THOMAS

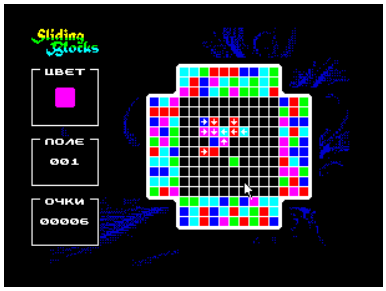


Mars attacks. In defense, humanity sends its most powerful weapon.... a jumping robot... I don't know the story to this game, but it might be something like that. We end up with a platform game with a main character that has no legs, but can hop. JET SET WILLY could also jump. Nevertheless, you can clearly see in this game that it's not 1984 anymore. The graphics are colorful and really very well done. Sounds are limited to 48k effects and I didn't see any big surprises. From a technical point of view it is a good game. Attention: do not start in 128k mode.

Download at:

https://spectrumcomputing.co.uk/entry/35326/ZX-Spectrum/Springbot-Mars_Attack

»SLIDING BLOCKS«
SANYOK
REVIEW BY THOMAS



Finally a game that requires strategic thinking. In **SLIDING BLOCKS** you have a lot of blocks around a playing field, in the middle are some colored blocks. You can slide the blocks from the sides into the center, whenever 3 of the same color touch each other, they dissolve. The goal is to clear the center. It is helpful to hit the suggested color, this will make several stones dissolve at once. It took me a while to understand the game principle, also because I can't read Cyrillic. But once you understand it, it's fun. The game has no extraordinary graphics and comes completely without a sound, but it is fun. If you like it tricky, download from:

https://spectrumcomputing.co.uk/entry/35325/ZX-Spectrum/Sliding_Blocks

»MORITZ THE STRIKER«
SEBASTIAN BRAUNERT
REVIEW BY THOMAS

...and one more on top. Sebastian Braunert was very busy and here is already the next game, which is distributed by Sintech also in physical version. This time we are dealing with a platformer again, but with an extra one. MORITZ wants to get a job at the Liverpool Football Club and he has to prove what he can do. In each level he has to overcome obstacles, collect the ball, shoot the corner flag with it and then get the ball into the goal. You need precisely timed jumps to accomplish this, not an impossibility, but anything but easy. The game is available as 48k and 128k version, where the 48k version plays the "HERE WE GO" soundtrack during the game as a beeper version, the 128k version uses the AY sound chip. After MANIC MINER finally again a 48k game with sound in the game. The graphics are still a bit too simple for today's standards, but the game is well done and varied. You should have a look at the opening credits of the 48k version, a "YOU'LL NEVER WALK ALONE" in beeper version, a masterpiece by Rich Hollins.

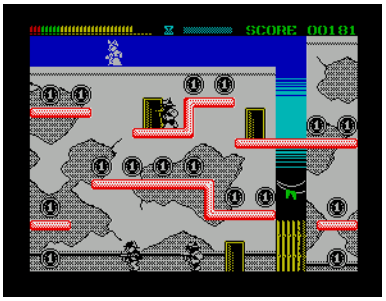
Free download at

https://spectrumcomputing.co.uk/entry/35793/ZX-Spectrum/Moritz_the_Striker

or the purchase version with 48k and 128k on a casette at Sintech:

https://www.sintech-shop.de/moritz-the-striker/a-10760

»BONNIE AND CLYDE«
ZOSYA
REVIEW BY THOMAS AND NOAH



BONNIE AND CLYDE is a classic story about a money robbery. The main character is **CAT CLYDE**, assisted by his beloved BONNIE. It is a kind of platform game with a lot of action. In the game you first have to collect all the coins, then a bomb falls from above, which you have to place at the safe. Once the bomb has exploded, you collect a bag of money and escape down the ladder that BONNIE has just lowered.

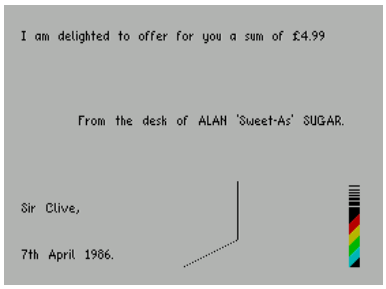
As usual from Zosya, we get very good graphics, which is still accompanied by a fun Charleston

music. The theme song sounds from the beeper, during the game it's AY music, Spectrum's without AY stay silent The difficulty level is just right, you stay motivated and it's not boring. The whole thing is set up like a real arcade game, the controls and collision detection are exact, the levels are varied and elaborately made. Very good game, just give it a try.

The game can be downloaded from Zosya's site as TAP, DSK or SCL, or you can buy the original on cassette with a very nice box on the same site:

https://www.zosya.net/product/bonnie-and-clyde/

»SIR CLIVE'S INK LAIR«
ANDY JENKINSON
REVIEW BY THOMAS

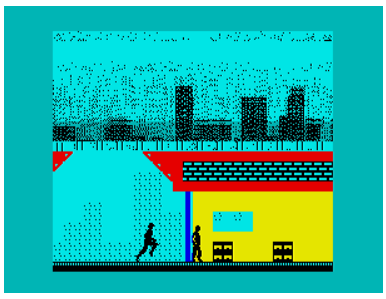


This is literally a "**GAME OF WORDS**". You control a line that passes through a letter from SIR CLIVE. Can you make this line go through the paper without touching a letter? You control only left and right, but it is not easy. If you steer too much to the right, it's hard to get back to the straight position, and at the same time the line pulls relentlessly upwards and the next row of letters comes closer.

The gameplay could have been done with anything, a graphic with gears, a planetary landscape...choosing a letter from SIR CLIVE is a particularly funny idea as well as the name. Despite that it is actually a simple game, it is fun. It was released as part of the CRAP GAMES COMPETITION 2020 and you can download it there:

https://connosoft.com/csscgc2020/reviews/026.html

»RUN!<<
ROMAN CIKRYT
REVIEW BY THOMAS



A simple game you think, because there are only 2 directions to operate, up and down. The game starts with the player running on his own. All kinds of obstacles come in his way and he has to overcome them. The player must quickly decide, jump or duck.

The game is, as you can imagine, very fast and exciting. The movements are fantastically animated and you almost want to run along (if it wasn't so hot and you weren't doing sports today of all days). The motivation factor is high, I tried again and again until I finally made it and then... Level 2...

You have an infinite number of attempts, that's the good thing. The graphics are a bit of a different style, not very detailed, but fitting for the gloomy future the game depicts. The characters are well animated and the scrolling is flawless. Technically a perfect game for many hours of fun, for 128k users accompanied by a fitting AY music. I am thrilled. Only one problem occurred: For some reason it is not running when MB02 interface is attached.

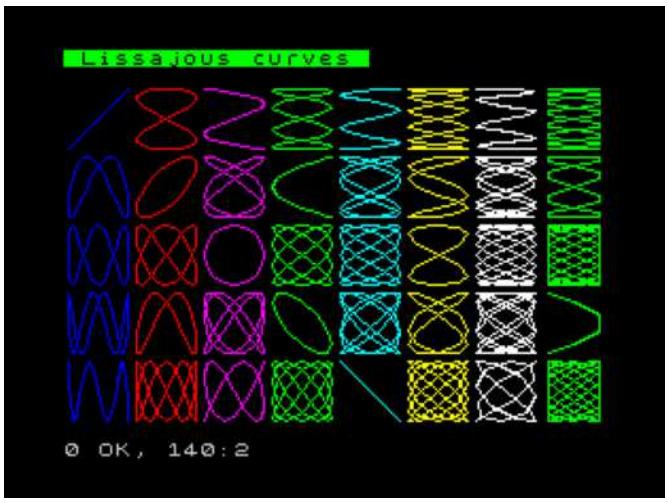
Download:

https://spectrumcomputing.co.uk/entry/36571/ZX-Spectrum/Run

BASIC GIMMICK 1

Calculation of Lissajous figures - a little different this time. With the kind permission of Uwe Geiken.

```
 10 REM Lissajous curves,
    v0.1, U. Geiken
 20 PAPER 0: INK 4: BORDER 0:
    BRIGHT 1: CLS
 30 LET r=14: LET d=32:
    LET s=2*PI/48
 40 LET p=0: LET q=0
 50 PRINT INVERSE 1;
    " Lissajous curves "
 60 LET y=159-d/2: FOR m=1 TO 5
 70 LET x=d/2: FOR n=1 TO 8
 75 INK n
 80 PLOT x+r*SIN p,y+r*SIN q
 90 FOR t=0 TO 2*PI STEP s
100 DRAW x+r*SIN (n*t+p)-
    PEEK 23677,y+r*SIN (m*t+q)-
    PEEK 23678
110 NEXT t
120 LET x=x+d: NEXT n
130 LET y=y-d: LET q=q+PI/4
140 NEXT m: REM : PAUSE 0
```



BOOKS
BY JOACHIM GEUPEL

When home computers were nearly state of the art and a religious war of the computer systems took place, there was also a lot of literature about the respective systems. The market was flooded with trade magazines that either dealt with the individual computers or published a motley collection of articles on the computers. I remember the German magazines like Computer Kontakt, Happy Computer, DataWelt, 64er and ST Computer. This list is by no means complete, because many of the magazines appeared briefly and disappeared just as quickly.

The same publishers also published books dealing with the various aspects of computers, certainly Data Becker was one of the busiest - as part of my hobby of collecting classic computers, quite a few books have come my way - including a few from Data Becker. Not only these but also some others I would like to present here. Let's start. I have arranged the books thematically, so the order does not correspond to the date of publication.

»ZX SPECTRUM HARDWARE EXTENSIONS« BY LOTHAR SCHÜSSLER

Data Becker publishing house, 348 pages, 1984
ISBN 3-89011-063-0

Lothar Schüssler presents, as the title says, some hardware extensions for the Spectrum 48. He takes quite an all-around approach and deals not only with the circuit board manufacturing but also with the Edge Connector, ROM and RAM, the obligatory PIO, in this case the universal 8255 PIO and a soundbox based on the well-known AY3-8912. He deals with the AY3-8912 for more than half of the book and tries to explain really everything. The AD converters 427 and 3162E are explained, a backplane with five slots is presented, an EPROM programmer based on the 8255 is found, as well as a memory expansion to 80kB. To present the whole book here is beyond the space. Of course, the book, like all the others, is only available antiquarian, if at all. Those who have it, hold a rarity in their hands.

»SIMPLE ADD-ON DEVICES FOR ZX SPECTRUM, ZX81 AND JUPITER ACE« BY OWEN BISHOP

Birkenhäuser Publishing, Computer Shop Series, 154 pages, 1984, ISBN 3-7643-1589-X

The original edition was published in 1983 under the title *"Easy Add-on Projects for Spectrum, ZX81 & Ace"* by Bernard Babani (publishing) LTD., London. ISBN 0-85934-099-6

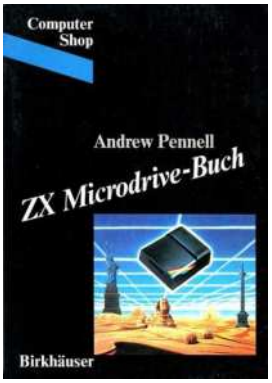
Birkenhäuser Verlag has published a whole series of Computer Shop books. Four of them are in my collection.

This book falls into the same category as the Data Becker book. However, the topics are different. Of course, the individual processor connections are explained first, although here the Z80 is introduced as a micro-computer rather than a micro-processor. Subsequently, the ZX computers, the Jupiter Ace, and the application to other Z80-bassing ones are explained. The selection of circuits is varied. The author starts with a pulse detector, then goes right into the thick of things and describes the construction of an image digitizer. In addition, a keyboard extension, a model railroad controller, buzzer, flasher, light pen, lap counter and the components of a weather station consisting of brightness meter, anemometer, temperature and air pressure meter and a rain detector are presented. The 154 pages provide concentrated knowledge and lots of suggestions for users who don't want to play with computers.

»ZX MICRODRIVE BOOK« BY ANDREW PENNELL

Birkenhäuser Publishing House, Computer Shop Series, 136 pages, 1984, ISBN 3-7643-1600-4

The original edition was published in 1983 under the title *"Master your ZX Microdrive"* by Sunshine Books, London, England.



This book is actually required reading for Microdrive and Interface 1 users. It explains first of all the terms "current" and "channel", the use of OPEN#, CLOSE#, CLEAR# and MOVE. Chapter 2 introduces the actual microdrive. It explains how to format MD cartridges, save and load programs - pretty much everything you can do with the microdrive in Basic without it taking off and flying away.

Chapter 5 contains an assembler program, embedded in Basic, that adds ON ERROR GOTO to the Spectrum's command set. Chapters 6 and 7 describe Interface 1 with RS232 and network operation. As already mentioned network, this is an application I tried once a long time ago and is covered in detail by Andrew Pennell. This chapter is very interesting, because exactly the application of the network is almost never presented, let alone explained. The last two chapters deal with

the programming of Interface 1 in assembler. Here it gets down to the nitty gritty - so to speak. Appendices A to C list the system variables of Interface 1, assembler listings and shortcomings in the IF1 operating system.

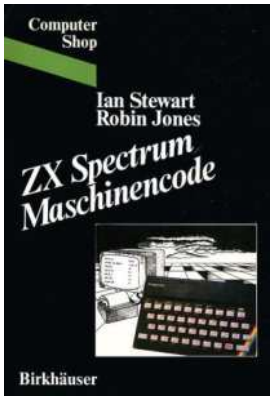
My personal conclusion is that this book explains both the Microdrive and the Interface 1 comprehensively. Again you find concentrated knowledge on few pages.

»ZX SPECTRUM MACHINE CODE« BY IAN STWEART AND ROBIN JONES

Birkenhäuser Verlag, Computer Shop Series,

124 pages, 1983, ISBN 3-4643-1535-0

The original edition was published in 1983 under the title "SPECTRUM Machine Code" by Shiva publishing Ltd., Nantwich, England.



The book is quickly explained. The two authors offer an introduction to machine code specifically tailored for the ZX Spectrum. It is admittedly a crash course, since Z80 assembler is actually quite an extensive task to learn and understand. The handling of numbers is explained, their positive and negative representation, jumps and subroutines, addressing, furthermore the handling of the Spectrum specific properties like the display, attribute file and display file. In the appendix there are a few tables and references to supplementary cards, which unfortunately are no longer included with the book.

The book is neatly done, but for learning to use assembler on the Spectrum it is not enough.

»MACHINE CODE ROUTINES FOR THE ZX SPECTRUM« BY JOHN HARDMAN AND ANDREW HEWSON

Birkenhäuser Publishing, Computer Shop Series, 162 pages, 1983, ISBN 3-7643-1559-8

The original edition was published in 1982 under the title "40 Best Machine Code Routines for the ZX Spectrum with Explanatory Text" by Hewson Consultants, Wallingford, Oxon, England, London, England.

Admittedly, I have not yet dealt with this book. It has only been sitting on my shelf, collecting dust. In reviewing it for this article, however, I have to say that this was a mistake. The two authors have gone to extraordinary lengths to explain Z80 assembler as well as how to use it on the ZX Spectrum.

Part A, the first part of the book explains in three chapters the Z80 assembler and goes into the structure of the memory, the registers, the stack and the display. In part B there are 40 (!) routines, which "open up possibilities in programming, which you always wished for! It is certainly up to the reader to judge this, but there are assembler routines included that were actually missing in 1983. These are line renumbering, scroll routines like moving attributes, characters and pixels to the right, left, up, and down; merging images - who needs it, screen inversion, REM generation, determining program length, memory copy and some more.

This book is certainly aimed at insiders, but it is also aimed at beginners who want to get started with Z80 assembler on the ZXS.

»HARDWARE EXTENSIONS FOR ZX SPECTRUM« BY JÖRG REINMUTH

Brandenburg Publishing House GDR, Amateur Library, 96 pages, 1990, ISBN 3-327-01030-7

One of the newest books in my collection is the book by Jörg Reinmuth presented here. It is actually a tragic work, because it was one of the last books published for the ZX Spectrum in the GDR. As far as I know, it was never published because the GDR ceased to exist as a state and was absorbed into the Federal Republic. It never went on sale and was even given away at some point. I bought my copy in the Sintech Shop, where some copies were offered for little money some time ago, but are now sold out.

The book is printed on thin paper, which, as I had to realize with another book from the GDR, tends to shrink and break easily. The other book is also from the GDR, an excellent math book from 1972, whose pages are yellowed and tend to break easily when turned.

The unlicensed replica of the Z80 was manufactured by VEB Mikroelektronik "Karl Marx" Erfurt in the GDR as the U880. The U880 was a fine piece of electronics. At least one version of the processor could be clocked up to 8MHZ.

Jörg Reinmuth introduces the processor U880 as well as the corresponding peripheral components U855, a Z80 PIO replica, the SIO U856, the error corrected replica of the Z80 SIO and the CTC U857,

a component which I will call a timer component in ignorance of its function (the friends from the former GDR may forgive my ignorance), and the DMA component U858, the replica of the Zilog Z80 DMA.

The book covers the topics that can be found in most other hardware books. The Edge-Connector is explained, the construction of a small computer, the installation of a reset button, the well-known video connection by means of a transistor, a light pen (in German called Lichtstift), a serial and a parallel interface and some more. Jörg Reinmuth attaches importance to extend the Spectrum with useful peripherals to be able to use it as a measuring device in electronic engineering. To the presented circuits the corresponding layouts are illustrated, that, if the grid dimensions are corrected, these can be rebuilt. The pitch of electronics in the GDR was 2.5mm instead of the western 2.54mm, so it could happen with larger components that the western equivalents did not fit.

The book is a very well done, Jörg Reinmuth has put a lot of effort into it. Unfortunately, due to circumstances, it never achieved the status it deserves. I found the book on ebay, Booklocker and Shopping.com, but fear that this is one and the same seller.

»ZX81 - ZX SPECTRUM« BY MICHAEL WIEGAND, MANFRED AND HEIKE FILLINGER

Otto Maier Verlag Ravensburg, 121 pages, 1984, ISBN 3-473-43210-5

This paperback is actually the last book I bought before I switched to the Atari ST. I found it in a revolving rack that was in an electronics store that hasn't been around for more than 30 years, but was long a place to go for hobbyists and people who called themselves electronics engineers.

The book is a pure software book, in which 15 programs for all possible applications are printed. Of course copying and typing and the Spectrum is tedious - nevertheless I copied one of them and later converted it to the ST, MSX-Basic, PC - first GFA-Basic, then QBasic, the Sharp MZ700 and a few other Basic dialects. The following programs are included in the book. Guess which one I implemented.

"WHO RATES WITH? ", "DAY OF THE WEEK", "ANNUAL CALENDAR", "CREDIT INTEREST AND INSTALLMENT SAVINGS", "DEBT INTEREST", "WAGE TAX/INCOME TAX 1983", "THREE-DIMENSIONAL DRAWING", "FUNCTION PLOT", "solutions of equation systems with n unknowns," "four wins," "master mind," "pipsqueak," "labyrinth, biological myths," "flower and plant calendars."

I assume that an outcry is now going through the community because everyone has been desperately waiting for the 1983 Wage and Income Tax Program since they are years behind with their tax returns. No, I have never needed the program, nor the one for solving equations with n unknowns.

So, that's it for now.

In my library are still a few books that I will present next time, some of them I have downloaded from the Internet, printed out and bound with a perfect binding system - how crazy is the guy actually? I'd rather have paper in my hand than reading from a screen, although in these days of tablet PCs and ebook readers, that can be done without effort.

Most of the books to come will be well-known, a few others rather less so. I have now introduced the lesser known ones. For me this is a journey into the past, into a time that was different but not better than today.

Joachim

BASIC GIMMICK 2

This programme calculates the circle number PI to 100 decimal places. A short warning is in order here: the ZX Spectrum REALLY needs a lot of time for this...

```
  5 PRINT "PI Calculation"
    ,,,,"Wait..."
 10 LET a=-1
 20 DIM X(332)
 30 FOR n=1 TO 331
 35 PRINT AT 5,0;n
 40 LET X(n)=20
 50 NEXT n
 55 CLS
 56 PRINT "Es geht los"''
 60 FOR D=0 TO 100
 70 FOR n=331 TO 2 STEP -1
 80 LET Q=INT ((X(n)+X(332))/
   ((n-1)*2+1))
 90 LET X(n)=10*((X(n)+X(332))
    -(Q*((n-1)*2+1)))
100 LET X(332)=Q*(n-1)
110 NEXT n
120 LET Q=X(1)+X(332)
130 LET X(1)=10*(Q-INT (Q/10)*10)
140 IF Q>99 THEN PRINT
    CHR$ 8;L+1;: LET Q=0
150 LET a=a+1
160 LET L=INT (Q/10): PRINT L;:
    IF D=0 THEN PRINT "."
170 INPUT #1: PRINT #1;d
180 IF a=10 THEN PRINT : LET a=0
190 NEXT D
```

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